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Organisational Phylogenesis:

Developing and Evaluating a Memetic Methodology

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Abstract

This research evaluates the unorthodox proposition that organisational development proceeds through the Darwinian processes of variation, selection and inheritance acting upon a non-genetic replicating code. This new replicator represents the fundamental unit of cultural transmission and was termed by evolutionist, Richard Dawkins, as the *meme*. The *memetic* position re-introduces many often neglected, sometimes shunned, evolutionary arguments into social and organisational debate by providing a naturalistic and plausible hereditary element upon which socio-cultural adaptation operates.

The popularity of the neologism 'meme' initially grew through rather *ad-hoc* non-scientific usage on the Internet. For some time, this geekish tendency has tarnished the idea of memetics and impeded serious academic investigation into the subject. A more rigorous philosophical treatment has been provided by Daniel Dennett who has argued that, while a science of *memetic cladistics* may be both desirable and feasible, it remains unlikely. On the other hand one of Dawkins' most famous critics, Mary Midgley, heralds dark forebodings that one-day memes may be given actual credence.

The present study necessitated the adaptation of conventional genealogical and taxonomic methods, for novel application in confirming congruence between actual organisational phylogeny and hereditary traits. One specific requirement was to develop a means of identifying, capturing and codifying such traits as *meme strips* for phenetic analysis. In order to handle the computational complexity inherent in the phenetic reconstruction algorithms, proprietary software had to be produced. This was extensively tested upon meme strips generated through simulated evolution. Western Christian denominational families provided a source of empirical evidence and demonstrated that the methods could be successfully applied to real organisational forms. A theological phylogeny was reliably reconstructed thereby upholding the hypothesis of cultural descent with modification based on a memetic replication. Further support for the claim was made in conjunction with the rendering of a facilities management market landscape. More importantly however, the results coming from this research suggest that the potential for formulating a science of memetics may be significantly greater than in Dennett original consideration.

2.1.1 Key Words:

Meme, Memetics, Cultural Inheritance, Natural Selection, Evolution, Darwinism, Dysteleology, Methodology, Isomorphism, Organisations, Natural Science, Social theory, Phenetics, Cladistics, Phylogenetic, Systematics, Taxonomy, Characters, Religious bodies, Software, MENDEL

Over memes there is, of course, a nightmare possibility of developing Dawkins's case. In a sufficiently depressed mood, a psychologist might really feel moved to describe the history of human thought in terms of its progressive infestation by conscious, self-interested, parasitical *bad ideas*.

Mary Midgley, *Gene-Juggling* (1979 p458)

... even if memes *do* originate by a process of "descent with modification," our chances of cranking out a science that charts that descent are slim.

Daniel Dennett, *Darwin's Dangerous Idea* (1995 p356)

2.1.2 Acknowledgements

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Directory of Studies (If Price), supervisors and advisors. Peer reviewers, proofreaders, those who have taken time to answer my questions and SHU's administrative teams. Numerous friends, Ivan and mum & dad.

This work is dedicated to my unfathomable nexus of memetic ascendants and descendents.

I hereby declare that this thesis has not be submitted, either in the same or different form, to this or any other University for a degree.

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Part 1: Background for an Organisational Memetics

What is society? I have answered: society is imitation

Tarde, 1903 p74

I think that a new kind of replicator has recently emerged on this planet. It is staring us in the face. It is still in its infancy, still drifting clumsily about in its primeval soup, but already it is achieving evolutionary change at a rate that leaves the old gene panting far behind.

The new soup is the soup of human culture. We need a name for the new replicator, a known that conveys the idea of a unit of cultural transmission, or a unit of *imitation*. 'Mimeme' comes from a suitable Greek root, but I want a monosyllable that sounds a bit like 'gene'. I hope my classicist friends will forgive me if I abbreviate mimeme to *meme*.

Dawkins, 1989 p192

"Ideas are the key you see. Ideas – we call them memes – cause learned behaviour the way genes cause instinctive behaviour"

"Memes." Something went click. Some of the titles she had read in the Index. "You used to call them ideons, didn't you?"

He blinked in surprise and looked at her respectfully. "Yes. Elementary ideas. Like elementary particles. Protons, electrons ... and ideons. The analogies were all physical back then. Later, when Darwin's and Mendel's works became better known, biological analogies seemed more appropriate. In a way, ideas are like viruses. People 'catch' them from each other through communication media. It's a process very much like epidemics. I could write the equations for you, if you like."

Michael F. Flynn In The Country Of The Blind (1990)

1.1 Background Introduction

1.1.1 Why are organisations?

On the basis that, for most individuals, relationships with various organisations are a cradle to grave affair then we might be justified in asking a few questions about them. One such fundamental question is 'why do organisations exist in the first place?' that is – *what are they for*? The answer would seem obvious: those bodies of society that might be called institutions, enterprises, companies, corporations or firms exist in order to do whatever they are put together to achieve. Whether that is to meet needs, solve problems, make widgets, educate students, punish criminals, win trophies, administer holy salvation or simply to make as much money as possible for their owners, organisations would seem to be human creations in which humans participate in order to serve some human purpose.

The word organisation itself is derived from the Greek word *organon,* meaning tool and it is implicit that organisations are considered as tools designed for the benefit of some section of mankind and in accordance with someone's will. This is the root of classical organisational thinking and the foundation for the majority of rational managerial models of control, planning, reporting and strategy (Porter, 1980). The apparent problem is that the modern organisational tool is intangible, rather abstract, and has tended towards greatly increasing complexity. Applying the organisation to its intended purpose is far from trivial and has been the source of much management anxiety. The perennial struggle to "get a handle" on the organisation has been met by wave after profitable wave of management fads and fashions devised by innumerable business gurus and quacks (Price & Shaw, 1998).

Typically, the comprehension of an abstraction relies upon reference to the familiar, which is why there is a penchant for metaphor in business dialogue. The comparison between the sometimes ruthless predatory character of commerce and nature "red in tooth and claw" are overly familiar to the business world and has spawned such clichés as "dog eat dog", "the rat race", "cat and mouse", "the concrete jungle" and "going to the dogs". Likewise, a form of corporate *totemism* is often descriptive of an organisational character such as "lumbering dinosaurs", "vultures", "wolves", "sharks", "cash cows" and so on.

Whether or not this totemic proclivity is deeply rooted in the human collective unconscious, it must be remembered that a distinction must be made between *signifier* and *signified*. Confusing the two tends to mislead rather than inform. A metaphor for an organisation is just a way of talking about an elusive concept and not the organisation itself (Morgan, 1986; Lakeoff & Johnson, 1980; Korzybski, 1933).

Why organisations exist, that is the purpose for which people forming into groups, is one matter; perhaps a more personal question needs asking first. '*Why are people?*' asks Richard Dawkins, professor for the public understanding of science, in the opening of his controversial book *The Selfish Gene* (1976). Since the dawn of inquiry this simple yet deeply profound and troubling question has perplexed children and philosophers alike. We look for the clues within our own ingenuity as purposeful, albeit imperfect artisans, manipulating the environment in accordance with our will. If all things bright and beautiful are created for some purpose then it is pertinent to ask : *for what and whose intent do humans serve*? Clearly, for the oldest epistemology, the mind of our creator must be so immense in comparison to ours that we can only guess as to why we are here.

Organisations obviously have purpose – there is however a serious problem with the obvious. It used to be "obvious" that mankind was a tool in the service of the divine creator. That was at least until Darwin and his followers estranged creature from creator by showing that life can arise through accident rather than by design. Similarly, just because it appears "obvious" that organisations are the purposeful instruments of intelligent managerial forethought - is it really the case, or is it blinding? The question '*why are organisations?*' is one pre-loaded with purpose. Perhaps instead, to see through the "obvious", it would be more pertinent to ask '*how do organisations form?*' Are these complex social entities, these institutions, organisations and corporations that surround and service us created through some intentional act of genius or did they emerge blindly in much the same way as organic life? It may be that the forces of natural selection are more influential to organisational formation than are usually credited.

Evolutionary views of social systems have been proposed since the 19th century; most infamously by Herbert Spencer (1870). Unfortunately previous efforts, having been tainted by misunderstandings and racial bigotry, have left social theorists distasteful and distrusting of applying Darwinism to society. On the other hand, practical management's chant of "survival of the fittest" vindicates callous, aggressive, and selfish decisions. The prevailing paradigm is still rooted in purpose, as otherwise management's forethought and self-importance would become undermined. In spite of rejection however, a shift to a Darwinian perspective reveals the congenital origins of many organisational deficiencies (Price & Shaw, 1998; Aldrich, 1999).

For evolution to proceed in organisations, as with organisms, there is a requirement for a replicating structure that is subject to variation & selection (Gabora, 1997). While organic life uses the mechanism of replicating genes, the idea of "corporate DNA" (Baskin, 1998) would seem to overstretch a metaphor. Dawkins has suggested genes are not the whole picture however, and that other replicators may exist. One such non-genetic replicator, he argues, is the fundamental unit of cultural transmission and evolution. Dawkins terms this a *meme.* More recently, the meme has begun to attract serious academic attention and, to some, has conferred tremendous explanatory power for many cultural phenomena. It has also been offered as a candidate mechanism of organisational inheritance and evolution (Price & Shaw, 1998). The concept of the meme then has potential to take the "organisation as organism" beyond metaphor and into the proper realms of scientific investigation (Tsoukas, 1991). As a foundation for a new science of organisations this is a hypothesis that needs testing.

Concurrently, the embryonic field of memetics predominates around heated philosophical arguments and it remains to be seen whether memetic methodologies are viable. Consequently there is no established way of testing the memetic hypothesis. It is the role of this research then to demonstrate the feasibility of a methodology that shows the potential of memetics as a science. By independently reconstructing phylogeny from organisational traits it can be seen that these traits are hereditary thereby indicating, or at least providing evidence compatible with, the presence of a non-genetic replicator – the *meme.* This helps to pave the way, for a science of organisational memetics.

1.1.2 The question: How are organisations to be classified?

Except for the hermit, organisations have a ubiquitous influence on human experience, yet these abstract social entities have evaded any fully coherent understanding (Burrell, 1997). Organisations are clusters of humans but, although humans are now widely accepted as being products of natural selection, the vast majority of management, organisational and sociological texts (modern and post-modern), shy away from reducing organisational complexity down to a naturalistic basis (reviewed in §1.2.1). To reiterate, this separation of the social from the natural has its roots within the notion of organisational purpose – the "why" question. Perhaps much confusion could be resolved through inquiring in the first instance as to *what* organisations actually are, that is - *how are organisations to be classified*? Are they natural, supernatural, artificial or something else entirely? Perhaps at a core level and for all our direct experience we might not actually know what organisations are!

An error in misclassification sets false premises, which could lead to overlooking essential properties or misunderstanding a phenomenon's origins and behaviours. Incorrect placement of organisations therefore preserves confusions as to their origins and activities[5]. On the other hand, accurate organisational classification, through explicitly mapped characteristics, would enable better knowledge formulation with respect to explaining organisational origins; how their structure develops; and the reason why they behave the way they do.

While academia is wary of the term *'predict'*, the practice of strategic thinking in anticipating the future is a common organisational trait and is particularly prevalent business enterprises. Clearly it is possible for social systems to blithely persevere, even prosper, in spite of ignorance and superstition; a more probable outcome, in the

[5] The underlying context of *neo-positivism* of the current research are considered in the assumptions of part 2.

absence of a guiding framework, is missed opportunity, lost competitive advantage or organisations leaving themselves wide open to industrial quackery and parasitism. A sound scientifically based classification of organisations, on the other hand, may act as the foundation for better development, change-work, consultancy intervention, problem solving, and workaday management.

The question of *what organisations are,* of course, is not new; definitions abound mostly employing words like 'people', 'activity', and 'objective'. These definitions unfortunately tend to permit the troublesome "why" question backdoor entry. To avoid the implicit presumption of purpose then perhaps the central issue needs rephrasing: *can organisations be classified as natural?*

While a consistent classification that is descriptive of the phenomenon and lends itself to scientific inquiry is desirable, conventional scientific approaches thus far have failed to do justice to social complexity. This should not be taken to imply that methodological inquiry should be abandoned, but rather that orthodox reductionist approaches[6] presently do not perceive the bridging concepts that make organisations amenable to natural science. Establishing the presence of bridging concepts is the first step towards realising *consilience* between social and natural order (Wilson, 1998) and towards a methodological classification of organisations. The recognised natural kingdoms do share attributes with social institutions and thereby constitute a broader grouping inclusive of organisms, organisations, and possibly other entities. Envisaging this potential super-class[7] deconstructs orthodox organisational assumptions and enables us to postulate (and subsequently investigate) organisational properties that are not readily apparent. In particular it presents *memetics* as a candidate for a bridging principle.

The Trojan task of determining how organisations, in the broadest sense, are to be classified is a big and tremendously important question; clearly way beyond the scope of any single research effort. Nevertheless, methodical refinement into manageable sub-questions that concentrate upon limited sub-sets of organisations, lays the steps

[6] In attempting to remove complexity
[7] A higher rank of classification may be proposed as being a subset of *complex adaptive systems* (Gell-Mann, 1994) in a hierarchy proposed in §1.1.6.3

towards the bigger answers. The question of organisation naturalism provides the *context* in which the present research operates: devising a methodology for evaluating a naturalistic classification (for specific research objectives see §1.1.4)

1.1.3 The organisational "gene" Hypothesis

In returning to first principles and asking whether or not organisations and organisms belong to the same natural super-class necessitates that they will have shared (possibly derived) characteristics. Potentially, organisations may come into being, less through purpose and design, as through some system of quasi-Darwinian evolution; demonstrating such, in at least one instance, would provide a strong case for pursuing a naturalistic viewpoint.

Evolutionary processes require variation & selection upon a replicating mechanism of inheritance; organically, genes mediate this. So, refining the question of natural organisational classification: *can organisations be classified as natural evolutionary products of some replicator?* The present research is a few steps removed from answering that question but Dawkins' meme concept, as '*fundamental unit of cultural transmission*' raises possibilities; it is a prime candidate for an organisational replicator. Therefore the present research starts with a proposition, which put succinctly[8] suggests that: *The meme is the organisational "gene"*. To oversimplify, an organisations' traits such as structure, behaviour, routines, and competences are expressions of some self-copying code, some replicating information. The implications are analogous to those of the "selfish-gene" hypothesis (Dawkins, 1976) and at least as controversial.

Empirically demonstrating the meme's organisational role is problematic: primarily, the organisational domain is too vast and diverse to be extensively and conclusively investigated; secondly and more pressing is that, while theories abound, there are no established research methods for organisational memetics. Presently the organisational "gene" hypothesis stands irresolvable, and consequently a more immediate methodological consideration is raised that constitutes the hypothesis of the present research: *a scientific method for indicating or refuting the presence of a*

[8] This will be stated more precisely and explained in part 2

mechanism of organisational inheritance is feasible. In other words: it may be possible to test the organisational "gene" hypothesis scientifically (greater detail will is given in part 2). Rather than performing the test exhaustively, the role of this research is to attempt to provide that test in the first instance, or at least to consider whether or not such a test may exist; doing so is the first step towards answering the bigger questions.

1.1.4 Research objectives

The forgoing considers the possibility of a test for a mechanism of organisational inheritance. Should this test be demonstrable then subsequent field application upon industrial or institutional sectors could be used to determine many evolutionary considerations; ultimately this could contribute towards establishing whether or not organisations can be classified as naturalistic phenomena.

The focus of the research then, is upon the test for a mechanism of organisational inheritance and is reflected by this thesis' title: *Organisational Phylogenesis: Developing and Evaluating a Memetic Methodology.* To explain, *organisational phylogenesis* encapsulates the underlying question of naturalism, implying that evolutionary processes are instrumental to the shaping of enterprises and institutions. Nature is amenable to natural science but, as there is no established test in the present field, then *development and evaluation* of a novel methodology is crucial. The term *memetic* has been woven into the title, both to highlight the appropriateness of this bridging principle for the investigation of social evolution, and also to stake the claim, on behalf of an emerging field, that memetics can be a valid and practical science.

1.1.4.1 Initial objective: Understand the problem

Revisiting the question as to what organisations are came from an intuition that the *meme* might remedy researcher's growing unease with contemporary organisational paradigms. A necessary component of the research therefore, is to comprehend and clarify the character of the problem in more formal terms. Revisiting the question may sound like a straightforward definitional issue but what does the *organisational*

"gene" hypothesis actually mean? Is it rational[9]? And is it worthwhile bringing conflict against serving organisational theories?

In appreciation of the magnitude and diversity of human social organisation then a key objective is to establish, within the constraints of a research degree, what specific aspect of the problem it should concentrate upon. The *knowledge as trees* metaphor becomes apt[10]; in the dark dense forest of theory, a seedling idea strains towards a shaft of light. A discipline that is just germinating has a set of imperatives significantly different to one that has already achieved maturity: Established (and well funded) fields employ tried and tested tools and tend to drill down deeply into narrow and ever increasing detail. For an emerging topic, on the other hand, the crux is to gather maximal contribution from limited recourses, using uncertain (if existent) methods; the important point is in establishing feasibility and potential worth.

For organisational memetics then, the first task is to comprehend the nature of a not-quite-so-straightforward problem[11]: given the present limits, in what ways does its relative novelty force demands upon methodological development? It is proposed that the greatest contribution can be made at this time by focussing on the groundwork and attempting to construct research instruments however primitive. Such effort paves the way towards establishing specific facts and details and may eventually lead to a new understanding of what organisations are and how they behave.

Another important aspect to understanding the problem is in recounting how prevailing organisational thinking developed: how competing academic agendas & taboos have marginalized Darwinian approaches to social inquiry; and how the *meme* concept is now re-enabling various theorists (detailed in §1.2.4) explore and propose evolutionary views of organisations. Should methods of organisational memetics prove feasible (and can be subsequently honed) then much needed empirical meat can be added to these theoretical bones.

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[9] In the sense of being a logical conclusion from stated premises – the argument is presented in part 2

[10] Even in the absence memetics' inferences.

[11] As distinct from the majority of social research degrees, the issue here is not about testing the hypothesis, but at a meta-level of *testing a test* for the hypothesis.

1.1.4.2 Core objective: Assess the methodological hypothesis that a test for organisational inheritance is possible

Arguably, memetics carries the promise of many parsimonious answers. Given the above prerequisites then the core research objective becomes to see whether it is possible to make a method that detects, or at least suggests, trait inheritance[12] in *real-world organisations*[13]. At this stage a crude test will suffice, as some indication of feasibility would lead to refinement and greater accuracy.

Assessing the methodological hypothesis requires a series of sub-objectives (further detailed in part 2): Having understood the problem, the *first* task is to establish the *rational criteria* by which we may know that some method is showing organisational traits are being inherited. The main criterion (argued in §2.4.2) is that: evolutionary patterns independently reconstructed from exhibited traits are comparable to known sequences of descent. Equipped with these gauges of success, the *second* sub-objective becomes to find candidate process to measure against them. In practice, and in keeping with the *isomorphic proposition* (§2.2.1.3), techniques drawn from biology proved suitable for translation to the organisational domain (§2.5).

The organisational "gene" hypothesis' intention is not purely theoretical but rather applies to real-world social systems. In recognition of the methodological objective then it would be *sufficient and necessary* to evaluate the positive case of the proposed process upon *one* actual sample. Ideally an additional falsifiable test against a negative case would support the methodological hypothesis; the issues, criteria and difficulties are discussed in §2.4.2. The *third* sub-objective then, is to select, a suitable organisational group that meets criteria for falsifiable evaluation of the methodology (stated in part 3); Western Christian denominations were chosen for the present test. However, before handling any real-world organisational data, it is prudent to validate the candidate procedure against idealised simulations.

Manual testing of the translated biological processes would be impractical owing to their high algorithmic complexity; to make them empirically and operationally amenable, a further sub-objective of constructing instrumentation was required. The

[12] and therefore a mechanism: the meme

[13] In the sense of what is commonly accepted as a real-world organisation e.g. business, government, religious group, professional body etc.

resulting custom piece of software (called MENDEL) automated the large number of calculations involved and provided graphical representations of inheritance sequences.

1.1.4.3 Auxiliary objectives: towards an organisational memetics

Depending upon the extent to which these core objectives can be met, then there will exist a feasible prototype for a methodology and tool that recognises patterns of organisational phylogenesis; many weaknesses will become apparent which constitute areas for improvement for later implementations. While attempting to meet the methodological objectives, a by-product of evaluation is that it does actually provide a first test for organisational "gene" hypothesis. In doing so it not only lends some much needed experient support to pre-existing memetic theories but also becomes an exemplar to encourage the development of memetics as an empirical science.

The present research is primarily intended to yield academic understandings; invariably such knowledge may hold practicalities. Through understanding the presence and role of replicating patterns in organisational development then it may eventually become possible to engineer, or cultivate, these memes as we see economically or organisationally fit (Price & Shaw, 1998).

1.1.4.4 Limitations: what the research does not *intend to show*

As noted before, a research degree pursuing methodology in an uncharted field would be struggling against serious constraints; objectives require careful prioritisation meaning that many intriguing avenues must remain unexplored for the time being. Moreover, in the course research, several by-products are thrown into light. Although incidental to the present research objectives, these were chosen deliberately for their general contribution to memetics. Confusion may arise without understanding how the ancillary results sit at a different level to the true methodological objectives (§1.1.4.1). It is worth being explicit about what the research is *not* about and does *not* intend to show.

Although the case focuses upon a subset of western Christianity the research has little to do with the social science of religion and is certainly unrelated to theology. While some memeticists may debunk faith as parasitical superstition, the case was selected

according to methodological criteria. Other candidates such as eastern martial arts and professional associations where also considered but faith groups were the most suitable for the study. The mechanisms of religion are a key theme in memetics however, and it is hoped that one can assist the other without blurring the primary research objectives.

Secondly, the research is not essentially concerned with reconstructing a definitive organisational "family tree" for the case study. Genealogical techniques were employed but these were used to provide a comparison within the method as opposed to attempting a complete canonical history of the house of Christ.

Thirdly, although organisational phylogenesis is argued for, and the *meme* is implicated, the research is neither aimed at proving any specific organisational form (religion), nor that organisations generally, evolve. As with genealogical techniques, successful application of phylogenic methods to the organisational domain would be consistent with descent and may be used to support the evolutionary arguments of others (Aldrich, 1999).

Furthermore, although modified genealogical and phenetic techniques are used the point is not to produce any definitive phylogeny based on traits; indeed the *third criterion* (in §2.4.2.3) demands that the phylogeny is reconstructed solely from history *without reference to traits.* Consequently the vast array of phylogeny techniques and programmes available to biologists, have little benefit to this research.

In close relation to evolution is the matter of establishing a mechanism of inheritance. To reiterate, the present maturity of the field necessitates methodological groundwork before attempting more ambitious demonstrations of the *organisational "gene" hypothesis* (§1.1.3). However, the case by which the methodology was evaluated provides a first indication of the underlying hypothesis lending support to theoretical arguments.

Fourthly, testing the possibility of a memetic methodology involved the construction of a crude prototype. Neither the resulting method nor the software was intended as

perfect or complete but rather was meant to enable the test and, subject to feasibility, provide a basis for later development.

Fifthly, the research is concerned with neither contemporary economic nor management arguments (although relevant key texts are reviewed), nor does it make any explicit claims about any organisation: economic, institutional, administrative, or otherwise. However, it remains the researchers contention that social organisations, in the general sense, have a naturalistic basis and evolve through an analogue of phylogenesis acting upon a memetic substrate.

Finally, the research does not provide any grand unifying theory of conciliating social and natural sciences[14] though it is hoped that the development of memetics into an acknowledged discipline can contribute towards such a goal.

1.1.4.5 Generalisability

The Western Christian denominations used for the case study were chosen for the purposes of simplifying the core objective of methodology evaluation. Although not a part of the aim, it is anticipated that results could be generalised, with lessening applicability, to wider religious cases, starting with other forms of Christianity, then monotheistic faiths (particularly Islam and Judaism), then to other more esoteric and cultic movements. Other forms of organisation, such as commercial business, economic enterprises and professional bodies are also removed from the ideal case but many do share some essential characters in terms of possessing structures, routines, and competences (McKelvey, 1978)[15]. It is hoped that a satisfactory memetic methodology will find its way into management research and, based on the promising phenetic reconstructions in the Facilities Management sector (Lord et. al. 2002), appears to have a degree of applicability outside the religious case. In accordance with the maturity of the fields and the research aims however, it is difficult to speculate upon the generalisability of a rough tool developed principally for the purposes of evaluating feasibility.

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[14] Similar to socio-biology, social Darwinism, evolutionary psychology, evolutionary sociology etc.

[15] A cladistic inference might argue that "faith" would be a shared derived characteristic (*synapomorphy*) among religious organisations. The more general features of organisations thereby might be seen as primitive (*sympleisiomorphic*) characteristics.

1.1.5 Note on terminology and style

1.1.5.1 Neologism

Memetics is still in its infancy and is particularly eclectic which means that many of the emerging concepts are products of invention and of a synthesis of ideas drawn from a plethora sources, mainly: philosophy, evolutionary biology, ecology, psychology, sociology, economics, epidemiology and theology. Moreover, its untamed evolution upon net-culture while, enabling creative input from all quarters did so without regulation on quality. The terminology peculiar to memetics reflects its heritage.

Memetics suggests that replicating packets of cultural knowledge, occasionally recombine or mutate into new complexes that have a greater ability to survive. Memetics, indeed, recognises itself as a meme (hence: *metameme*) and owes its origin and title to Dawkins' (1976) re-twisting of the *concept of genes* to form a novel hybrid with the *concept of culture.* Because of its origins and self-referential nature, memetics tends to attract those who are susceptible to conceptual innovation and novelty. These, so-called *memeticists* perpetuate the *meme-line* of identifying biological phenomena that have cultural counterparts and trying to interpret what that phenomena could imply sociologically. These recombined concepts are usually conveyed by new, stolen or imitated terminology. A typical trick is to simply replace the word '*gene*' with '*meme*' wherever it appears. Deliberate neologisms are commonly used to provide an intuitive distinction between analogous processes in systems that are biological (*biota*) and those that are not (*abiota*).

A few of the examples already seen have been Wilkins' (1998)[16] *phemotype* (as analogous to the biotic phenotype) and Langrish's (1999) *seletemes*, *recipemes* and *expanemes.* Glen Grant (1990[i]) has produced an extensive lexicon of memetic terminology.

In an attempt to preserve academic standards, this dissertation treats neologism cautiously. In many cases however, the new terminology conveys a far clearer

[16] Wilkins also presents a glossary of technical terminology.

meaning than that which previously existed and so will be used where appropriate at other times however, "scare" quotes may be more useful.

1.1.5.2 The Abiota

The term *abiota* emanates from ecology[17] and is used to provide a counterpart of the biota. A modified meaning is introduced as referring to "non-living" yet "life-like" complex adaptive systems. From this, auxiliary neologisms such as *abiote*, *abiotic*, (*abiology* even!) may be ascribed meaning.

The biota concept suggests aggregation of a rank higher than super-kingdom, which herein will be termed a *domain*[18]. The biota and abiota would then be seen as separate domains, and together (perhaps with others) would constitute members of some yet higher rank of complex adaptive systems. Such clusters can be proposed as extensions (fig. 1-1) to the classification hierarchy of organisms though their layout and naming remain to be determined.

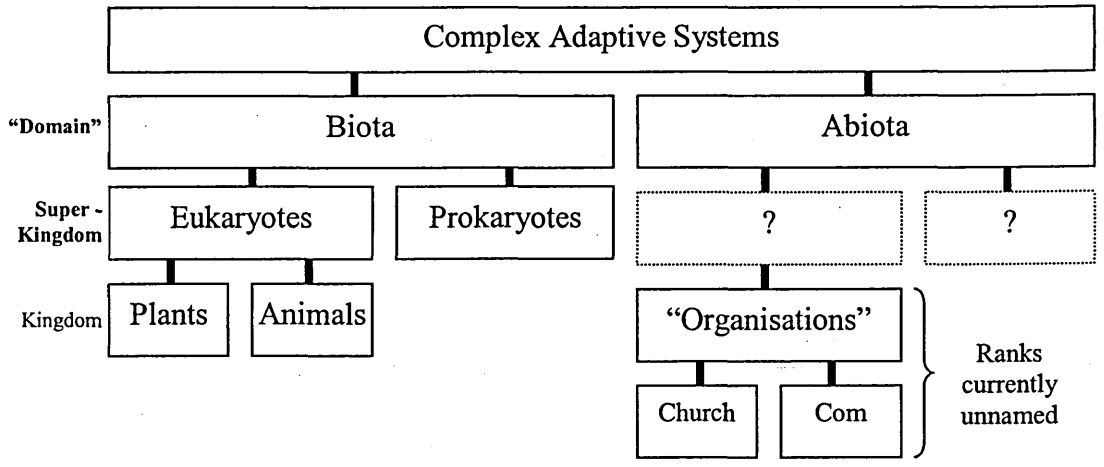

Figure 1-1. Possible extended classification to include *abiota*

Somewhere within the ranks of the *abiota* we might find commercial enterprises, government departments, church bodies, political parties, professions, and other social entities that are commonly termed as organisations. The abiota therefore encapsulates a more general class of phenomena while avoiding differing claims from sociology, economics, or anthropology (Price & Lord, 2000). Although the details of this

[17] Non-living factors which are present in and affect the characteristics of a given ecosystem

[18] I use this to illustrate the idea of higher ranks rather than attempting to coin new nomenclature. Other terms such as *continent, plate, empire, federation* may be more representitive.

proposed scheme remain to be worked out, the methodology anticipated by the current research goes some way towards its development.

1.2 Converging strands of literature

> With an increase in the richness of descriptions and experiments, sociology is drawing closer each day to cultural anthropology, social psychology, and economics, and will soon merge with them. These disciplines are fundamental to sociology *sensu lato* and are most likely to yield its first phenomenological laws. In fact, some viable qualitative laws probably already exist. – [Wilson, 1975 p574]

Knowledge is often depicted as a tree, forever branching as greater detail and deeper insights are made. Specialisms emerge, with their own terminology and assumptions, which build upon previous knowledge in the field. Most research efforts and discoveries can be suitably classified as a component of the particular subject area from which it emerged. However, because different disciplines are tightly focussed on their own narrow band of concerns they become insular and largely inaccessible from outside. They no longer see what others are doing and don't recognise commonalities and redundancies of knowledge.

In contrast, memetics has no pedigree. Rather than branching out from an established discipline it is a re-unification of many diverse strands of thought. Memetics is a hybrid (or mongrel) of, among other things, philosophy, psychology, sociology, evolution and information theory. Though easy to become distracted by academic territorialism, it is not so easy to identify where or too whom memetics "belongs". It is perhaps best to abandon boxing memetics into an existing classification and to consider it as an independent and newly "speciated" area of inquiry[19].

Emanating from the parochial struggle for recognition against a backdrop of established theories[20], a basic question arises 'what phenomena are meme theory actually attempting to explain?' The pre-existing knowledge environment has served to shape memetics. Consequently surveying ancestral theories helps to clarify the pastiche of assumptions upon which meme theory draws and provides a benchmark by which to evaluate whether or not meme theory provides a more elegant explanation.

The approach here is chronological, emanating in prehistoric mythology through to the most recent "on-topic" arguments. A summary of the history of related theories is

[19] It is partially the role of this review to differentiate the memetic approach from prior means.
[20] Or as memetics would suggest, fitness landscape.

followed by contemporary views on evolution, complexity and organisations. The scope and maturity level of present memetics is outlined and finally brought together as the organisational memetic theme that forms the basis for the current research.

1.2.1 Historical interlude

An excursion into history is taken in order to distance memetics in general, and this thesis specifically, from potential look-alikes, namely: Social Darwinism, Sociobiology and Evolutionary Psychology. Memetics represents a progression from Darwinism by arguing that para-biological evolutionary strands may exist. Applying 'Darwinian' as an adjective to 'organisational theory' results in a departure from orthodox business, management, and sociological positions that is reminiscent of the of the Darwinian paradigm shift from prior views.

There are notably emotive objections to "Darwinising" society, owing to its historical justification for social oppression. So while evolutionary views may bring new understandings of society, they also inherit prior "hang-ups" and misunderstandings. Reviewing theories of creation, evolution, society, organisations, management as well as early memetics in their historical context highlights potential errors and misunderstandings that, with reference to contemporary theory, organisational memetics should differentiate itself.

1.2.1.1 From Creation to Darwin

Darwinism's *natural* philosophy is fundamentally opposed to pre-Darwinian theories that have a *supernatural* commonality. A journey into antiquity illuminates the essential philosophical contrast that give rise to arguments on both sides of the evolutionary debate. The ultimate question (by definition) concerns the *universe and everything,* how did it begin, when and, perhaps more curiously, what is its *purpose.* Shermer (1997, p129) suggests that, of the mythical accounts for cosmogenesis, the *supernatural being's spoken edict* variety (creationism) prevails[21] in large tracts of Western and Middle Eastern culture.

[21] Part 3 gives evidence that evidenced creationism is a robust self-sustaining *memeplex*.

Aristotle classified causes as the *aitia* (Dennett, 1995; Sproul, 1995), calling the *final* cause, the purpose for which something is made, the *telos*. Dennett (1995) raises its philosophical importance:

> A teleological explanation is one that explains the existence or occurrence of something by citing a goal or purpose that is served by the thing. Artefacts are obvious cases; the goal or purpose of an artefact is the function it was designed to serve by its creator. - [Dennett, 1995 p24]

Dennett notes the obvious purposefulness of artefacts but the purpose of nature, life, humanity, and the universe are not so immediately apparent. Teleological aetiology, when applied to nature, entails that behind life, the universe and everything lies the intentional, intelligent design of the divine artificer; and in defy natural explanation, are un-amenable to human inquiry. The biblical view contends that since genesis, and excepting man's fall from grace (Gen 3:7), creation is the perfect product of intelligent design, brought into existence by supernatural forces to meet Gods mysterious purpose; as divine quality assurance was *right first time* then there is no need for re-work.

Darwin's Galapagos finch observations, lead him to question the stability of species from which he formulated the controversial theory of evolutionary transformation. Evolution is such a massive paradigm shift that, because it recasts cosmogony in a naturalistic light, it becomes not just a test of, but also a significant threat to faith. Reliance upon an intelligent designer or supernatural conjuring tricks is obviated as biological structures of bewildering complexity can emerge naturally and without any intent whatsoever. As Dennett puts it

> One of Darwin's most fundamental contributions is showing us a new way to make sense of "why" questions. Like it or not, Darwin's idea offers one way- a clear, cogent, astonishingly versatile way- of dissolving these old conundrums. – [Dennett, 1995 p25]

Religion's response is that Darwinism equates to materialism (Yahya, 2000) and is accompanied by moral nihilism, lawlessness and anarchic selfish brutality. Darwin gives the appearance of justifying *laissez-faire* in which anything goes. Greed, cruelty, and sadism are encouraged while pain and suffering are the norm[22]; a

[22] Religion is a highly complex phenomenon regarded herein from a naturalistic and neutral memetic stance, which would suggest that certain constituents are symbiotic (Reynolds & Tanner, 1983) while others parasitical. On a very personal note, I believe that stripping parasitical memes away from institutionalised memeplexes may lead to greater spiritual understanding and I understand that liberal

misconception that continues to tarnish any natural science of society. More recently the evolutionary perspective has been challenged by *intelligent design theory* (IDT), which downplays dogma in favour of empiricism and rationalism (Behe, 1996). IDT contends that *irreducible complexity,* stemming from the astronomical improbability of organic self-organisation, indicates that biological order must arise through intention (Behe, 1996). Although a reasonable teleological conjecture, IDT has become a propagandist tool for *crypto-creationism* and, far from contributing towards knowledge, has become the thin end of wedge towards enforcing some pseudo-scientific religious agenda[23] (Shermer, 1997).

Fortunately, creationist's attacks enable science to correct erroneous assumptions as the neo-Darwinian revision: Mendel's *factors*, which later lead to the idea of the gene (Margulis, 1995), the molecular structure of which Watson & Crick unravelled; the incomplete fossil record incompatible with *gradualism* was reconciled by *punctuated equilibrium* (Eldridge & Gould, 1972); the apparent altruism of symbiosis and socialisation that counter-exemplified the "law of the jungle"[24] was bridged by *simulations* that demonstrated how blind selfishness is sufficient for evolving mutual cooperation (Axelrod, 1986; Dawkins 1989). However, much of neo-Darwinian theory, represented by evolutionary psychology and sociobiology, has been gene-centric, which fails to account for many biological phenomena[25]. Although Dawkins (1976) argues that *The Selfish Gene* is the fundamental replicating unit of biological selection, he goes on to suggest that the gene is not alone as a replicator but is accompanied by the *meme.*

1.2.1.2 Culture, society, organisations and management

The Enlightenment was about rationality; it was the *age of Reason.* With reason came the ideal of *progress:* that greater knowledge would give rise to a superior way of living, and science would solve all problems[ii]. It is easy to see how the a progressivist interpretation of Darwin's theory, the "survival of the fittest[26]" view, would sit well

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theologians (Bob Spooner, private communication) acknowledge memetics' somewhat paradoxical contribution.

[23] I would like to rename this ideological hijacking as BTD (*belligerent design theory*); at the same time I would like to see scientific challenges to the new orthodox irrespective of the source.

[24] a popular misconception of natural selection

[25] The humanities consider themselves irreducible to natural science

[26] a phrase coined by Herbert Spencer

with his Victorian contemporaries of scientists, engineers and politicians. Somehow though teleology seemed to have crept back in to "natural" selection and was compounded by progressivism to suppose that nature's intention was towards producing the "fittest" species (Dennett, 1995); the "fittest", being riddled with anthropocentric bias towards anatomical superlatives. In addition, was *the naturalistic fallacy* whereby what '*is*' is confused for what '*ought to be*'[27]

Evolutionary enlightened science may debunk holy order, but in stripping humanity of purpose, ethical vacuum in left in its wake. What could science offer in exchange as social, political, cultural, and moral guidance? As the essays of Smith and Malthus had assisted Darwin in consolidating his theory of evolution then it was already conceivable that evolutionary forces also operated in the human world. Herbert Spencer applied the principle to sociological phenomena, race, and class in a view known as *Social Darwinism.* Owing to the confusions, misunderstandings and prejudices of the time, as descriptive, Social Darwinism may have been flawed, but as a scientific prescription for social progress it became a pathogenic combination. Social Darwinists advocated a *laissez-faire* political and economic system where the elite had natural right of power justified by a completely selfish ethic known as *rational egoism*[iii]. Galton's[28] argument for *hereditarianism*, promoted higher frequencies of desirable character by discouraging dysgenic procreation. Taken to the extreme, eugenic arguments were used infamously to fuel fascist ideology of engineering a "master race", culminating in genocide in the name of progress. This association has daubed Social Darwinism daubed as "scientific racism" (Hossain, 2000)[iv], which has served to cement the irreducibility of the humanities and erect barriers against natural science perspectives on socio-cultural phenomena

While attempting to preserve scientific objectivity both Sociobiology and evolutionary psychology consider natural evolutionary explanations for human social behaviour. However, neither possesses sufficient explanatory power for providing a coherent theory of human society (*q.v.*). Sociobiology, is a special case of the *adaptionist* program[v], which states that genetics is the sole factor responsible for the

[27] A distinction ironed out by Hume http://www.talkorigins.org/faqs/evolphil/social.html
[28] Galton was Darwin's Cousin and like Quetelet, Huxley, Lombroso, Bertillon & Babbage considered science and social progress http://www.maps.jcu.edu.au/hist/stats/quet/index.htm

behaviour in humans and animals. "Pop sociobiology" (Kitcher, *ibid*), frequently associated Wilson (1975), particularly raises controversy as it forcedly redirects analysis towards people. The entirely endogenic bias upon human behaviour tends to provoke reaction especially as it threatens notions of agency and behavioural choice, usually resulting in hackneyed and distracting old nature versus nurture debates. Closely related is *evolutionary psychology*, which re-combines the two sciences: evolutionary biology, and cognitive psychology (Evans & Zarate, 2000). In essence, psychological aspects are dependent upon physical brain structures that arose through primitive adaptations. This behaviourist view then contends that action is encoded in, and for the propagation of, the selfish gene.

Extrapolating gene-centricity of both evolutionary psychology and sociobiology, persons are reduced to '*lumbering robots blindly marching to the orders of their selfish genes*[29]', which presents both denial and abdication of morality, of rights and responsibilities, on the grounds that action, however sophisticated, is innate and fixed. Furthermore, as Wilson's ladder is a proscription of social engineering, then we are beyond redemption[30]. Although an entirely molecular evolutionary basis rejects supernaturalism or free will, *exogenetic* factors are discounted. From the gene-centric perspective culture must have an entirely genetic basis - a conclusion that is clearly untrue! Humans are capable of cultural acquisition so, ether culture crosses the Weismann barrier, or the claim that "it's all in our genes" is wholly insufficient for a theory of society.

In defiance of the modern view and Wilson's forecast that sociology will yield viable quantitative laws, the post-modern[vi] abandonment of chasing positive absolute truths is away from the naturalistic perspective of society; there is no one meta-narrative that pulls everything together[vii]. Instead relativism is held and knowledge is seen as a construct of society (*social constructivism*) arising from discourse between participating agents. Such human agency is a teleological perspective of intelligent intentional conduct. So, although neo-Darwinism has made many corrections, the negative connotations of Social Darwinism, combined with the academic popularity of post-modernism, have impeded naturalistic views of society.

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[29] Paraphrasing Dawkins (1976)
[30] Appendix J suggests an entirely opposite perspective.

Management perspectives have followed a slightly different path. Economic, technological, and demographic changes that accompanied early 20th century modernity necessitated a change in management style from *ad-hoc* intuition to rigorous formalisation. The early theorists, Taylor, Fayol (1949) and Weber (1947) focused upon the rational elements of work. Thoughtless workers acted on managerial orders towards some industrial purpose. The famous Hawthorne studies (Roethlisberger & Dickson, 1939) however, revealed that productivity varied in accordance to sociological conditions[31]. The objective of Mayo (1933)[viii] and the human relation school that followed him was in the reintegration of the *intraorganisational* factors by harmonising the formal and informal organisation. The sociological approach (Warner & Low, 1947), which additionally considers *extraorganisational* factors, was built upon as the contingency view that rejects Taylor's "one best way" edict in preference to "it depends" upon the environment (Emery and Trist, 1965), whereupon the organisation as an *open system*[32] (Merton, 1957).

In difference to the analytical approach, the systems approach[ix], emerging from *General systems theory* (Bertalanffy, 1968; van Gigch, 1978), considers complex interconnections, relationships, dependencies and control between elements that comprise the whole. Contingency theorists began to notionally introduce systems ideas into organisational investigation. Contemporaneously, operational research suggested that lessons learned from cybernetics (Ashby, 1963) could advance management science (Beer, 1967; Johnson, Kast & Rosenzweig, 1967). The practice of *systems analysis* is the organisational application of GST (Jayaratna, 1994, Burrell & Morgan, 1979; Cutts, 1991; Checkland, 1981; Checkland & Scholes, 1990; Senge 1990). More recent notions of non-linear dynamics have introduced *complexity* and *adaptation* into the systems paradigm and are supportive of evolutionary ideas of organisations (as will be seen).

Returning to faith, the teleological essence of Christendom has permeated into much secular and modern management ideology. It will be later argued that neo-Darwinian

[31] the workers felt special for being included in the study
[32] in difference to the Classical school's *closed system* perspective

revisions, *Complex Adaptive Systems* and memetics provide a reducible dysteleological account. The extragenetic replicator may overcome prior difficulties (patched by the elusive notion of agency) and associations with social Darwinism, thereby re-enabling a coherent evolutionary perspectives on culture, society and organisation.

1.2.1.3 The introduction of memetics

Attempts to introduce evolutionary concepts into social study have been thwarted by ideological baggage. Before discussing how contemporaneous concepts such as neo-Darwinism, complexity and organisational evolution are starting reacquaint sociology with science, the origins of the term meme, as a conceptual bridging device, are noteworthy.

It might be considered that memetics has been through three eras[33] and is now entering a new age. At the outset, (*era 0*)[34] understanding was essentially proto-memetic in that early thinkers could see this thing "out of the corner of their eye" but had no theoretical model to hang their observations or ideas upon. *Era 1* are the twenty years following Dawkins' (1976) coining of the word "meme". A new word had been cast into the world and exploratative minds were pondering what meaning, if any, it had. This era saw the meme following its own theoretical contagion pattern, which culminated in the mid-nineties with a series of books, a symposium and the launch of an electronic journal[35], in the name of an emerging new science. These events signified the dawn of *era 2* (and current era) whereby serious academic consideration is being given as to whether memetics constitutes anything worthwhile or is it just a rehash of a tired old ideal. Further, this era has seen attempts at developing memetic research methodologies (of which the current research programme is a constituent). If current research efforts deliver their promise then they may attract favourable selection pressure and enter into *era 3.* This future time might be where memetic theories gain mainstream acknowledgement, if not acceptance, and

[33] this is loose terminology and I employ it in the present context to separate different stages of the development of memetics.

[34] These eras are numbered here from 1976 as the beginning of era 1. Before that, the proto-memetic age is era 0. I would have liked to have concatenated Meme era into *memera*, but this may be taking neologism too far.

[35] Journal Of Memetics: Evolutionary Models Of Information Transmission. (JOM: EMIT) http://www.cpm.mmu.ac.uk/jom-emit/

methodologies start to become operationalised particularly in the organisational and institutional domains.

This section will discuss the tender formative years of memetics up until the mid nineties. Contemporary debate (or what has here been proposed as *era 2*) will be detailed in a later section (§1.2.3). The anticipated emerging era (*era 3*) and beyond will be speculated in part four and appendix J.

1.2.1.3.1 Proto-memetics (pre-1976)

As with the concept of evolution, there was allusion to the memetic idea even before the term was coined in 1976. Such thinking however wasn't about natural selection of social systems, as this had been covered by Spencer, but rather with the atomisation of socio-cultural phenomena into fundamental units of analysis. Much of the early thinking predates genetics and metaphors were based on prevailing paradigms of the period.

As early as 1841 Mackay had examined collective delusions & mass hysteria[36] noting that men both think and go mad in herds. Le Bon (1895) built upon this suggesting that the individual, immersed within a crowd's collective mentality, becomes highly hypnotically suggestible which paves the way for thought contagion; he believed that people literally catch mental illness[37] from each other (cf Lynch, 1996). Park (1904) ignores this preferring a sociological explanation of how people imitate & reinforce each other in a circular reaction. Gabriel Tarde (1903) observed how a particular crime appeared to spread like waves through society by the process of *imitation* (Marsden, 2000[x]; Williams *s.d.*[xi]). Tarde proposed that, instead of the group's or individual's perspective, society could be viewed as concepts or behaviours used to classify groups[38]. To Tarde, there were two forms of imitation, specifically, the *logical laws of imitation* that followed a rational basis and *extra-logical influences* that where imitations independent of truth or utility[39]. Baldwin was well aware of

[36] including economic fads exemplified by *tulipomania*

[37] Although not an academic paper, Lord (2000) suggests certain memes are pathogenic and may be treatable through hypnotherapy.

[38] the "memes eye view" which would also classify an organisation by its routines & competences

[39] Incidentally, Tarde also raised the possibility that it may be possible to engineer successful imitations

Tarde's early work and, in what is considered[xii] to be one of his lesser contributions (1894), makes the statement:

> If we grant a phylogenetic development of mind, imitation ... may be considered the law and the only law of the progressive interaction of the organism and its environment ... Morally I am as much a part of society as physically I am a part of the world's fauna; and as my body gets its best explanation from the point of view of its place in a zoological scale, so morally I occupy a place in the social order; and an important factor in the understanding of me is the understanding of it.

Here, Baldwin paraphrases *abiotic* evolution using imitation as the mechanism of inheritance.

Levi-Strauss[xiii] (c. 1950s) application of *structuralist* ideas (Saussure, 1916) suggests why myths may be structurally similar despite considerable variation in the details of characters and events. Analysis may be performed over two dimensions: the *diachronic* dynamic (or melodic[40]) that conveys content; or *synchronic* static snapshot (or harmonic)[41] that denotes structure. In order to analyse a myth's structure it needs to be reduced into its basic units which Levi-Strauss termed *mythemes*[42]. In this sense mytheme has distinct similarities to the meme although there is no inference that the mytheme is a replicator. Bultmann's[xiv] structural perspective on the New Testament was an attempt to demythologise scripture to reach the underlying *karygma*.

The generation of ideas and Darwinian evolution has been noted from the end of the 19th century (e.g. Poincaré and William James). Popper (1963) initially developed a full epistemology of science and spoke about *conjectures* and *refutations*. Campbell (1960, 1974), who introduced the term *'Evolutionary Epistemology'* (also Popper, 1972, 1984; Hayek, 1973; Lorenz, 1977; Dempsey, 1996[xv]), generalized Popper's falsificationist philosophy of science to encompass knowledge processes at all biological, psychological and social levels. However, evolutionary processes are refined into *blind-variation-and-selective-retention* (BVSR) and universal selection theory takes these to their logical extreme (Cziko, 1995, Haylighen, 1997, Edmunds, 2001[xvi]). Cloak's (1975) cultural ethology also predated Dawkins in his introduction

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[40] the musical metaphor can also be considered as the difference between watching a time based oscilloscope trace and a frequency based spectrum analyser. These are related by the Fourier transform.
[41] This distinction between the diachronic and synchronic (related to the genealogical and phenetic methods respectively) is important to the development of a memetic methodology as will be discussed in part 2.
[42] Mythemes as units of myth are differentiated from the fundamental units of language: *phonemes, morphemes, sememes, lexemes etc.*

of i-culture and m-culture, which Rose (1998) finds less ambiguous 'meme'. McKelvey (1978) introduced the *tech-pool*, as organisationally analogous to the gene pool[43] (see §1.2.2.3.4).

1.2.1.3.2 Identifying a second replicator

In *The Selfish Gene* Dawkins (1976) made the point that the gene is the fundamental unit of inheritance, as opposed to the individual or kin; altruism is later substantiated (Dawkins, 1989)[44] with reference to Axelrod's (1986) evolution of cooperation. As noted above gene-centricity fails to account for the *culture* that makes the human organisms unique (cf. Blackmore, 1999) Dawkins complains:

> ... I find that they [theories of kin selection and reciprocal altruism] do not begin to square up to the formidable challenge of explaining culture, cultural evolution, and the immense differences between human cultures around the world ... - [Dawkins, 1976 pp190-191]

In accordance with Campbell's rule, organic evolution is but one instance of a more general model of evolutionary change (Blackmore, 1999 after Durham, 1991; Cziko, 1995) then Darwinism then isn't limited to genetics.

> ... for an understanding of modern man, we must begin by throwing out the gene as the sole basis of our ideas on evolution. I am an enthusiastic Darwinian, but I think Darwinism is too big a theory to be confined to the narrow context of the gene – [Dawkins, *ibid* p191]

Liberating evolution from the constraints of genetic selection leads to a leads to a leap of abstraction: there may be other replicators enable non-organic evolution.

> The gene, the DNA molecule, happens to be the replicating entity that prevails on our own planet. There may be others. If there are, provided certain other conditions are met, they will almost inevitably tend to become the basis for evolutionary process. – [Dawkins, 1976 pp192-193]

In the original edition of *The Selfish Gene* (Dawkins, 1976, p206) the meme as second replicator was defined thus:

> [the meme is]... a unit of cultural transmission, or a unit of imitation.

A later definition (Dawkins, 1982, p109) makes a more specific distinction between the meme and its effects (as analogous to the genotype – phenotype distinction):

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[43] Although this paper appeared two years after the publication of *The Selfish Gene*, it is not known whether McKelvey was aware of Dawkins (1976), as it is not referenced. From the nature of the paper on *organisational systematics* and from McKelvey's non-use of the word meme it is more likely that the idea arose independently.

[44] For consistency reasons, citations from *the selfish gene* will default to the 1989 edition unless otherwise stated.

> ... I was insufficiently clear about the distinction between the meme itself, as replicator, on the one hand, and its 'phenotypic effects' or 'meme products' on the other. A meme should be regarded as a unit of information residing in a brain ... It has a definite structure, realized in whatever physical medium the brain uses for storing information ... I would want to regard it as physically residing in the brain. This is to distinguish it from its phenotypic effects, which are its consequences in the outside world. - [Dawkins, 1982, p109]

The first, more general definition of *meme as fundamental unit* has been called *Dawkins A* while the *meme in the head* definition called *Dawkins B* (Gatherer, 1998 see also §1.2.3.3.2). More recent arguments have focussed on the validity of memetics as a science based on the distinctions between definitions. The difference is clear from the examples provided (Dawkins, 1982):

> Examples of memes are tunes, ideas, catch phrases, clothes fashions, ways of making pots or building arches. Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so meme propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation. - [Dawkins, 1989 p192]

In the revised version such cultural elements become the effects or expressions of memes, which are now seen as constructs of the mind (Dawkins, 1982)

> The phenotypic effects of a meme may be in the form of words, music, visual images, styles of clothes, facial or hand gestures ... They are the outward visible (audible etc.) manifestations of the memes within the brain. - [Dawkins, 1982 p109]

Simply re-labelling a construct of the mind, as 'meme' however, contributes nothing understanding culture; the explanatory power is that certain conceptual objects can replicate analogously to genes.

The *Dawkins A* definition is reminiscent of Tarde's idea of an imitation, almost a century earlier. The meme, possessing replicator power, takes on a quasi-vitality of its own. Although Tarde had noted that *extra-logical influences* allow false or foolish imitations to occur, this fails to explain the nature of human foolishness. On the other hand, the idea of blind, selfish replicators is illuminating; the virus of the mind image becomes apt. The notion of a mental parasite manipulating the human body for its own selfish ends, irrelevant of truth or utility makes much of human stupidity comprehendible and makes sense of Tarde's *extra-logical influences of imitations*.

By shifting the focus of benefit, irrational belief systems, superstition and religion[45] can be understood from a naturalistic angle. It has become customary for memetics to

[45] Creationists, for some reason, seem to object to having their urge to spread their belief in a divine maker compared to the symptoms of an advanced case of syphilis.

analyse *propaganda fide,* the church and religion and (in many cases to mock) blind faith's intolerance of alternatives (part 3).

> If [a meme] is a political or religious idea, it may assist its own survival if one of its phenotypic effects is to make its bodies violently intolerant of new and unfamiliar ideas. A meme has its own opportunities for replication, and its own phenotypic effects, and there is not reason why success in a meme should have any connection whatsoever with genetic success. – [Dawkins, 1989 p110]

Although a healthy dose of scientific scepticism serves to immunise civilisation from resurgent outbreaks of mentally debilitating fideism, there seems to be more than an element of ramming the final Darwinian nail into God's coffin. Memetics is self-conscious in recognising that science in general, and memetics in particular, are nothing more than memes[46]. Self-reference enables an evolutionary epistemology of memetic interpretation to be attributed to scientific processes (Hull, 1988); pseudo-scientific (More, 1994), ideological hijacking and other parasitical memes can be identified and weeded out. Furthermore, memetic self-reference recognises the problems that science faces in that *extra logical influences* may be more determinant to the acceptance of an idea than its truth or utility[47].

> If [a meme] is a scientific idea, its chances of spreading through the world's scientific brains will be influenced by its compatibility with the already established corpus of ideas – [Dawkins, 1989 p110].

Acceptance of a scientific idea then depends upon its fitness within the existing academic terrain; what is currently *en vogue*, respectable, getting media attention or attracting research funding (and hence researchers). While the methods of science may claim a degree of objectivity, or at least are humble enough to recognise their own fallibility, diffusion of an idea may be thought of in epidemiological terms.

> If a scientist hears, or reads about, a good idea, he passes it on to his colleagues and students. He mentions it in his articles and his lectures. If the idea catches on, it can be said to propagate itself, spreading from brain to brain. – [Dawkins, 1989 p192] ... If the meme is a scientific idea, its spread will depend on how acceptable it is to the population of individual scientists; a rough measure of its survival value could be obtained by counting the number of times it is referred to in successive years in scientific journals. – [Dawkins, 1989 p194]

Through memetics, self-recognition of the non-scientific aspect of the process of science (Hull, 1988) has driven much of the ensuing debate about the validity of memetics. The introduction of the idea of memetics itself is an object lesson in

[46] This is the meme-meme or the meta-meme (Brodie, 1996) and its intrinsic self-referential aspect gives it a central role in the epistemology of memetics

[47] Assuming non-relativism, whereby not all ideas are equally true or useful

academia's immune response to an invading meme and is reminiscent of Christianity's almost allergic reaction to Darwinism.

> Biologists, as we have seen, are accustomed to looking for advantages at the gene level (or the individual, the group, or the species level according to taste). What we have not previously considered is that a cultural trait may have evolved in the way that it has, simply because it is *advantageous to itself.* [Dawkins, 1989 p200] ... Time and again my sociobiological colleagues have upbraided me as a turncoat, because I will not agree with them that the *ultimate* criterion for the success of a meme must be its contribution to Darwinian 'fitness'. – [Dawkins, 1982 p110]

The point of difference that has marked Dawkins out as "bad boy evolutionist" (Wired, July/Aug 1995) is that the simple idea that something may be "advantageous to itself". Cultural elements therefore may be self-effacing rather than being a product of either human ingenuity or genetic selection. So far, the two continents of sociology and biology have resisted merger. The meme provides an isthmus that threatens to overturn theories in both biology and the social sciences. For biology, the meme means that genes are not the whole story. For the social sciences, it replaces agency with dysteleology.

While mytheme, imitation, and tech-pool, considered by "pre-Dawkinsian" *era 0* thinkers, come close to the concept of the meme they miss out on the rich source of inference generated by the replicator idea. Particular value is derived from enabling evolutionary account of socio-cultural phenomenon. Culture, society, institutions and technology, in this view, become self-effacing systems serving their own replicators' survival.

1.2.1.3.3 Twentieth century memetics (1976 - 1996)

The publication of the selfish gene in 1976 marked the beginning of *era 1* of memetics. While previous thinkers had concepts that were in need of a word, Dawkins had introduced a word that was looking for a meaning. Before examining more contemporary ideas (§1.2.3) of what this term has come to entail, it is worth re-viewing some of the more important developments in the metameme's history.

The meme brought about a few flutters of interest between the late 1970s and the early 1990s as various independent thinkers noted Dawkins' literary device and began to envisage its factual (Hofstadter, 1980) and fictional (Flynn, 1990; Spinrad, 1991) implications. By the mid 1990s the idea was starting to snowball, as more people

spotted its curiosity value. As the deluge of literature continued, some of which was well considered, the meme began to attract serious attention by eminent names and instigated contemporary intellectual discourse as to the value of memetics as a potential new area of inquiry (thus marking entry into *era 2* §1.2.3).

Dennett's (1995) argued that life could arise purely from random happenchance given incidentally hospitable environmental conditions, without recourse to *intelligent design theories* (Behe, 1996; §1.2.1.1). Although clarification of the dysteleological argument is a common among writers of evolutionary philosophy (Monod, 1971; Dennett, 1995; Dawkins, 1976; 1982; 1986; 1995), Dennett parts company with sociobiology and takes on-board Dawkins' (1976) notion that genes may not be the whole story; he explicitly takes up the *meme's* role in the evolution of human consciousness. Bodies themselves do not a culture make. Something possesses these bodies to act sociably. An *invasion* by some kind of "body snatcher" as Dennett has it.

The meme may circumvent the limitations a gene-centric cultural explanation but, in preserving the deterministic adaptationist bias, also preserves much about what people find objectionable about sociobiology. The frosty reception given by existing theorists (for example Gould, 1997; Midgley, 1979, 2001) Dennett suggests

> ... that the meme's-eye view of what happened to the meme meme is quite obvious: "humanist" minds have set up a particularly aggressive set of filters against memes coming from "sociobiology", and once Dawkins was identified as a sociobiologist, this almost guaranteed rejection of whatever the interloper had to say about culture – not for good reasons but just in a sort of immunological rejection. –[Dennett, 1995 pp361-362]

There are perhaps simpler *extra-logical influences* as to why the meme is unattractive, partly to do with antipoetic Gigeresque "parasitical" imagery[48], and partly to do with the human craving to be special (Monod, 1971). Moreover, it challenges the hallowed ground of the gene.

Whose benefit then are adaptations are for; as Dennett puts it *cui bono?* Selfishness (Dawkins, 1976) projected onto the meme-centricity of culture entails that *the memes of culture exists for the benefit of the memes of culture* irrelevant of the group, individual or for that matter even the selfish-gene. Crucially, elements of culture may

[48] Gatherer's (1998) objection to the *virus of mind* metaphor (§1.2.3.3.2) is not on the grounds of aesthetics but limitations of the over-popular metaphorical vehicle.

actually become detrimental[49] to the organic platforms that they are "supposed" to support; a position contentious to much cultural, social, organisational, managerial and political (particularly Marxist) theory.

A far more serious problem, notes Dennett (1995), is that while memes may offer a sound theoretical naturalistic explanation for human cultural phenomena (however enticing or repugnant this may seem), methodological barriers inhibit the development of a proper scientific endeavour of memetics.

> ... lines of descent are hopelessly muddled, and that phenotypes (the "body designs" of memes) change so fast that there's no keeping track of the "natural kinds." ...even if memes *do* originate by a process of "descent with modification," our chances of cranking out a science that charts that descent are slim. – [Dennett, 1995 p356]

Dennett does however show optimism in establishing descent in *semantic* properties of certain cultural entities that is reminiscent of Levi-Strauss' structural study of myth. The problem is in asserting whether two seemingly related ideas precipitated independently owing to similar yet isolated cultural conditions (famously and relevantly, by Darwin and Wallace) or whether imitation with variation is at work. In raising the problem of cultural homology, Dennett explicitly suggests that the *cladistic* tracing of character lineages may form the backbone of a cultural science.

> This is the same epistemological problem, in the science of culture that taxonomists confront when they try to sort out homology from analogy, ancestral form derived characters, in cladistic analysis ... Ideally, in the *imagined field of cultural cladistics*, one would want to find "characters" – literally, alphabetic characters – that are functionally optional choices within a within a huge class of problem alternatives. – [Dennett, 1995 p357 emphasis added]

Neither why "characters" should be alphabetic nor why Dennett does not associate characters directly with memes (or expressions thereof) is uncertain. It becomes apparent, however that Levi-Strauss' structural study is tantamount to *phenetic* analysis – that is classification by resemblance (Sneath & Sokal, 1973) and where such *mythemes* are demonstrably inherited (i.e. are actually memes) then *cladistic* analysis (Hennig, 1966) becomes relevant. It is partially the role of the present research to improve the chances of "cranking out" a science of culture.

Lynch, (1996) makes the relationship between memetics and historiography explicit.

[49] I have coined the term *threshold(s) of self-efficacy* to (loosely) denote the point(s) at which a meme passes from a mutualistic to parasitic relationship with its host(s)

> Modern historiography already branches into the histories of ideas, knowledge, inventions, and religions. Memetics, on the other hand, is a theory of how history unfolds, one pertaining to the history of mass belief. Memetics also seeks to explain the form and prevalence of current beliefs, and how these might change in the future. The situation resembles the analogous relationship between the evolution theory and the discipline of palaeontology, where palaeontology parallels historiography and evolution theory parallels memetics theory. Though evolution refers to biological history, it cannot incorporate a full account of that history. Likewise memetics cannot incorporate a full account of human history. – [Lynch, 1996 p37]

Again there are echoes of that Levi-Strauss's dimensional distinction (Fig. 1-2) between the *diachronic* (the dynamic unfolding historical narrative, akin to palaeontology and historiography) and the *synchronic* (static ahistorical structure dimension, akin to evolutionary theory and memetics). In a sense, the positivist historian Buckle may also be seen as a grandfather of memetics.

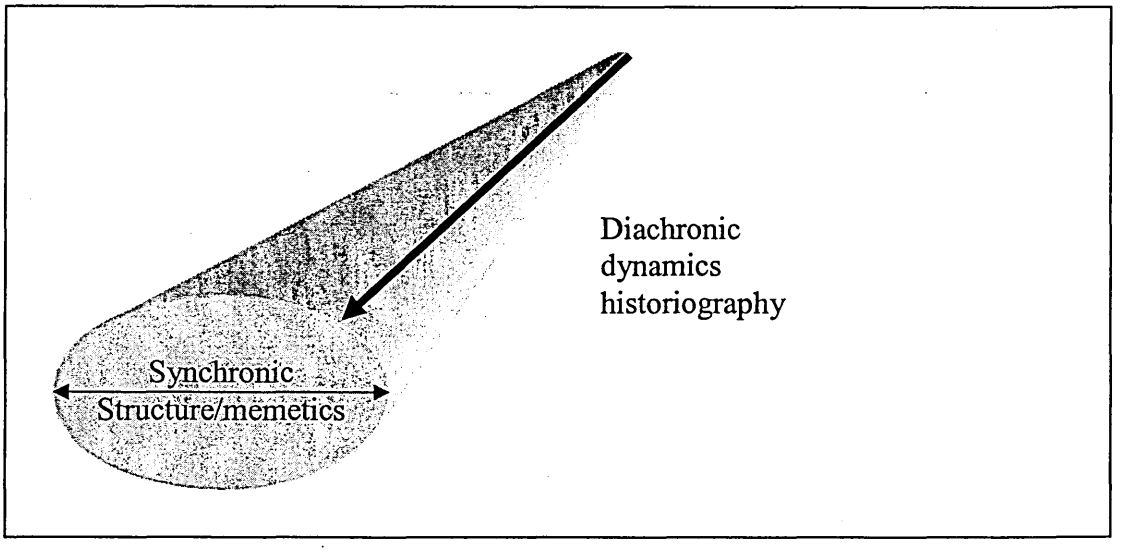

Figure 1-2 Relationship between diachronic and synchronic

Although Brodie's (1996) approach is less academic, he suggests three definitions of the meme: the *biological* view as a basic unit of cultural transmission (after Dawkins, 1976); the *psychological* view as an internal representation of knowledge (after Plotkin, 1993); and a *cognitive* view as a kind of complex idea that forms itself into distinct memorable unit and spreads by vehicles that are physical manifestation of the meme (after Dennett, 1995). Brody offers his own *virus of the mind* definition that equates to *Dawkins B* (Dawkins, 1982; Gatherer, 1998) which he takes to its alarmist conclusion. He does however join Dawkins' (1989) rebellion against tyrant replicators in his optimism that memetic engineering and *disinfection* may offer both human development and a way out of slavery and despair.

Fog (1996) presents a *tour-de-force* history of cultural selection theory and considers the position of memetics, defined as fundamental unit of cultural selection, relative to other evolutionary social theories. From ethology, r/K selection theory (Wilson, 1975) is adapted to fit cultural selection (Fog, 1996, 1997). Extremes of evolutionary strategy r and K[50] have been relabelled as cultural strategies *regal* or *kalyptic* respectively; unfortunately the terminology becomes highly confused and Fog's examples seem to indicate that kalyptic is more akin to r and regal to K! Criticism aside, Fog implies memes may take r and K selection based on their cultural climate which reflects Reynolds & Tanner's (1983) conclusion regarding reproduction rate, *per capita* energy consumption and religious orientation.

Fog (1996) comments about the state of both memetics and the mind of "memeticists" at the time. Prevalent was the emotionally charged *virus of mind* strain (Brody, 1996; Gatherer, 1998) that previously had prompted Midgley's (1979) angst. Sensationalist non-scientific imagery (Dennett, 1990) had the meta-meme surfing the crest of a cyber-cultural tsunami.

> Meme theorists have a peculiar penchant for self-referential theories. ... This extraordinary scientific self-awareness has led many meme theorists to present their theories in the most popularised way with the deliberate, and often proclaimed, aim of spreading the meme meme most effectively. – [Fog, 1996 p30]

While much memetic musing was of muddled quality, the meta-meme, as ill-defined chunk of Internet geek jargon, was diffusing; a mixed blessing as *pop-science* equates to *pseudo-science* in the minds of "serious" academics. However, it *infected* enough people that a few began to ponder beyond the morass and into the actual value behind Dawkins' innovation: what might memetic selfishness imply?

> While meme theorists agree that most memes are beneficial to their hosts, they usually concentrate on adverse or parasitic memes, because this is an area where meme theory has greater explanatory power than alternative paradigms. – [Fog, 1996 p28]

Which not only explains Tarde's *extra logical influences* but also confers with Dennett's previous assertion that meme theory should be accepted only if it helps us to understand 'deviations from the normal scheme' (Dennett, 1995 p364). Fog however points out the eagerness of memetics in identifying some virulent, out of

[50] Whereby r symbolises reproduction (species fecundity) rate of while K is the carrying capacity (number of individuals of a specie that the environment can sustain). Small, fast growing & breeding organisms, such as insects and mice, are favoured by r-selection while K-selection sustains a low population density of large, slow growing animals that are higher up in the food chain (eg. Elephants and humans).

control, fad or fashion and labelling it as a meme[51] while little attention has been paid to the development of reliable epidemiological or other numerical models supported by hard data. Perhaps this is one of the reasons why Fog shares Dennett's pessimism for the development of taxonomy.

> The products of cultural evolution or conceptual evolution cannot be systematized into distinct classes and it is impossible to make a strict evolutionary taxonomy of cultures. – [Fog, 1996 p30]

The conjecture of the current research is that the limited maturity level and theoretical strength of memetics has prevented solid empirical research. We are now however entering an era where contemporary interdisciplinary approaches are pointing towards the feasibility of memetic methodologies.

1.2.2 Contemporary thought

There are problems associated with keeping up-to-date with the literature of an intrinsically eclectic and exponentially developing field[52]. The meta-meme seems to be enjoying the epidemic of fame that it predicts. In this literary explosion, there is probably more related research "in press" than there is in publication and so it is important to narrow reviews to what is relevant.

This section looks at three contemporary strands related to organisational memetics. First is the new science of complexity, which offers further explanations for the origins of life, and societal organisation. Second, evolutionary psychology draws upon contemporary evolutionary theory when considering human systems but avoids the ideological baggage of social Darwinism and sociobiology. Third, current evolutionary schools of organisational thought illustrate theoretical convergence.

This review will proceed to examine current state of memetics and then finally move onto the core theme of organisational memetics.

[51] Indeed Wired magazine features a monthly list of top 10 memes! www.memepool.com does similar.
[52] Bearing in mind that the bulk of memetic literature has been published since embarking upon the current research.

1.2.2.1 Complexity, chaos and order

Although complexity is not a direct component of the current research this "new science" has provided fresh insights into natures puzzle and is enabling the acceptance of neo-Darwinian evolutionary theory into the framework of social understanding.

The Newtonian and enlightenment conceptualisation of the universe was that it obeyed regular laws like clockwork and sufficient investigation would eventually reveal the formulae that are followed. The view was that complicated behaviour would be mapped by complicated functions. Paradoxically Freeman's (see Gleik, 1988) meteorological simulations demonstrated chaotic unpredictability of non-linear dynamics that is: infinitely complex behaviours could arose from very "simple" functions. The growing availability of cheep computer processing power stimulated both an artistic and scientific fascination with the dynamics of *chaos*. Accompanying this came the vocabulary and images of swirling *strange attractors*, the beetle-like *Mendlebrot set*, garish fractals (fractional dimensions), cascading bifurcation and self-similarity (Gleik, 1988). Many of the generated images bore an uncanny resemblance to the patterns of order of found in nature such as trees, ferns, coastlines and clouds. It became a possibility that, underlying the bewildering complexities of nature are just a few elementary rules.

From absolute order to utter chaos is a continuum. Both extremes are hostile to life; too much regularity constitutes a high entropy situation whereby energy necessary for sustenance can no longer be transferred; too much turbulence and structure is torn apart. Between lies a narrow band of *Complexity* in which life is '*poised at the edge of chaos*' (Kauffman, 1993). Complexity essentially inquires as to how mind-numbingly intricate and sophisticated systems arise through a set of fundamentally simple intrinsic rules upon regularities or *schemata* (Gell-Mann, 1994). *Self-organisation,* otherwise known as *autopoiesis* (Maturana & Varela, 1980), is typically exhibited by *complex adaptive systems*[xvii], which are expression of schemata. The value of complexity theory here is that it provides a naturalistic account[53] of how living and sociobiological systems can arise through Darwinian evolution acting upon a comparatively simple replicating molecular substrate (Waldrop, 1992; Gell-Mann,

[53] and demolishes the *irreducible complexity* objection thrown up by intelligent design theorists in their meme's need to preserve a supernatural creator.

1994). Human social systems too can be viewed as self-organising complex adaptive systems. From this position it is possible to consider how culture and social organisation may also be complex expression of a simple non-genetic replicator. Gell-Mann (1994) makes explicit the connection between *schemata* and the meme.

1.2.2.2 Towards and away from an evolutionary sociology

A debate between Runciman and Giddens held at the London School of Economics in June 2001 represents both a mild resurgence in evolutionary considerations within sociology while at the same time reiterates many confusions and taboos that proliferate. Runciman and Dennett (who was in the audience) have written on the topic of memes and while Giddens may not have, his structuration theory conveys the notion of reproduction. However, with the exception of Marsden, the 'M' word went un-uttered. A report of events is given in Appendix N.

1.2.2.3 Organisations evolving

Academically, organisations, as societal entities, tend to attract sociological or anthropological treatments. As these tend to dismiss evolutionary ideas as generally irrelevant to their concerns then institutional evolutionary theory has inherited "wild fringe" status and has become somewhat marginalized by the field. However, "outsiders", whose backgrounds and interest in organisations are not primarily sociological, have begun to reintroduce more naturalistic orientations particularly in the light of complexity and neo-Darwinism.

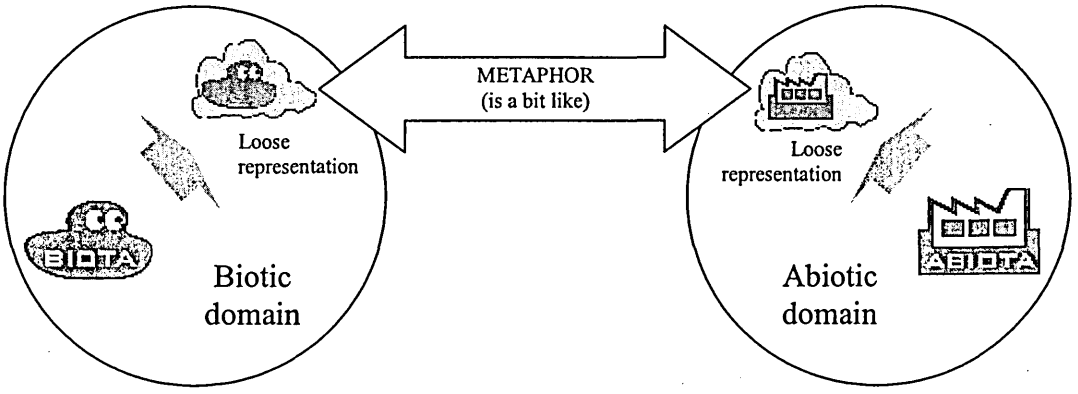

Figure 1-3 Organisation as organism metaphor

Positions on organisational evolution range from loose metaphorical allusion to attempted formulations of greater rigour. Such thinking, it will be argued, has been converging with the current research albeit without the notion of the meme, which offers the mechanism for evolution.

1.2.2.3.1 Morgan's images of organisations

Morgan (1997) indicates that it is common for managers (among others) to employ imagery in their attempt to understand and control organisations; metaphorical representations bring familiarity to complex, intangible and abstract social entities. Morgan's point is that the ability to see things from "new angles" (or different metaphors) introduces new possibilities and solutions (Gordon, 1978, Lakoff & Johnson, 1980; Tsoukas, 1991). To this end, he does not go beyond the level of organisational metaphor. Although several images are explored, the two representations most relevant to the current investigation are *organisation as machine* and *organisation as organism.* The distinction between "mechanistic" and "organic" approaches to organisation and management was previously pointed out by Burns and Stalker (1961). These essentially opposing metaphors are reminiscent of the contrasting views where intelligent design verses blind emergence, and suggest the perceived degree of management agency in organisational activity.

From the mechanical perspective managers are seen as the designers and operators of sophisticated institutional tools and it is their foresight, calculation, experience and knowledge that keeps the machine "well oiled" and running efficiently. Success depends upon the ingenuity of top-level strategies and the ability of management to implement their policies. The view is that the organisation is a closed system and is given the analytical approach with little regard to extraorganisational influences. Clearly mechanical images of organisations are related to the early classical schools of scientific and administrative management.

The strength of this metaphor is that mechanistic approaches to organisations work well in contexts where machines work well. That is, for a definable repetitive task in a predictable, stable, orderly environment (cf Fordism). The drawbacks as pointed out by Merton as far back as 1957 and rephrased by Morgan (1997, p28) are:

> ... mechanistic approaches to organization often have severe limitations. In particular they (a) can create organizational forms that have great difficulty in adapting to changing circumstances; (b) can result in mindless and unquestioning bureaucracy; (c) can have unanticipated and undesirable consequences as the interests of those working in the organisation take precedence over the goals the organization was designed to achieve; (d) can have dehumanising effects upon employees, especially those at the lower levels of the organizational hierarchy. –[Morgan, 1997, p28]

So, while the mechanistic model is efficient in an orderly world, where the *causal texture* becomes a *turbulent field* (Emery & Trist, 1965), or in contemporary parlance, encroaches upon the *edge-of-chaos* conditions, then a rational rule base however *complicated* can never be sufficient to handle systems *complexity*.

Contingency theory, with its consideration of extraorganisational influences, was a movement from the mechanical to the organic. Organisations *as organisms* are driven by survival needs. Selection, though market forces operating upon competitors determines the shape of those who continue to exist. Here the commercial environment is capricious & unforgiving and merely grants those that *satisfice*[54] a continued existence. Management decisions are relegated to epiphenomenona and the best they can hope for is sufficiently quick adaptation to shifting circumstances.

Each metaphor, as Morgan states, has its merits and the principle advantage of the organic model is that it emphasises lifelike characteristics and relates the organisation with its environment in a way that the mechanical model does not. As an open system, an enterprise is entirely contingent upon its surroundings and "needs" must be satisfied in order it to survive (Price & Shaw, 1999). The *organisation as organism* also makes the parallel to biological evolution and shows commercial competition in the light of Darwinian natural selection. Within this analogue arises the organisational "specie" concept (cf McKelvey, 1978) that suggests the reason for niche activity and differences in organisational characteristics.

There are however, as Morgan states, weaknesses to *organistic* image. One difficulty is the disanalogy with functional unity whereby when organism's subsystems work against each other then the results may be fatal. Different elements of an organisation

[54] http://web.uvic.ca/akeller/pw406/resources/design/satisfice.html Defines: To obtain an outcome that is good enough. Satisficing action can be contrasted with maximizing action, which seeks the biggest, or with optimizing action, which seeks the best.

(people), on the other hand can and do lead separate lives. Another point, and more of a warning than a weakness, is reminiscent to the problems of Social Darwinism that modern theorists are keen to avoid.

> ... the danger of the metaphor becoming an ideology. This is always a problem in applied social science where images or theories come to serve as normative guidelines for shaping practice. – [Morgan, 1997 p71]

The main danger here is that while academia may deal with neutral abstractions, practicing managers hanker after realistic solutions and so tend to be dismissive of philosophical nuances. Misapplication of Darwinian theory by management is as potentially tragic as social Darwinism.

Morgan's images serve as a good starting point for seeing whether or not the *organisation as organism* metaphor can lead to greater scientific rigour and naturalistic understanding of institutions. Whittington's strategic positioning adds another dimension.

1.2.2.3.2 Whittington's perspectives

Whittington (1993) also encounters the concept of evolution in the organisational domain with the question *What is strategy and does it matter?*

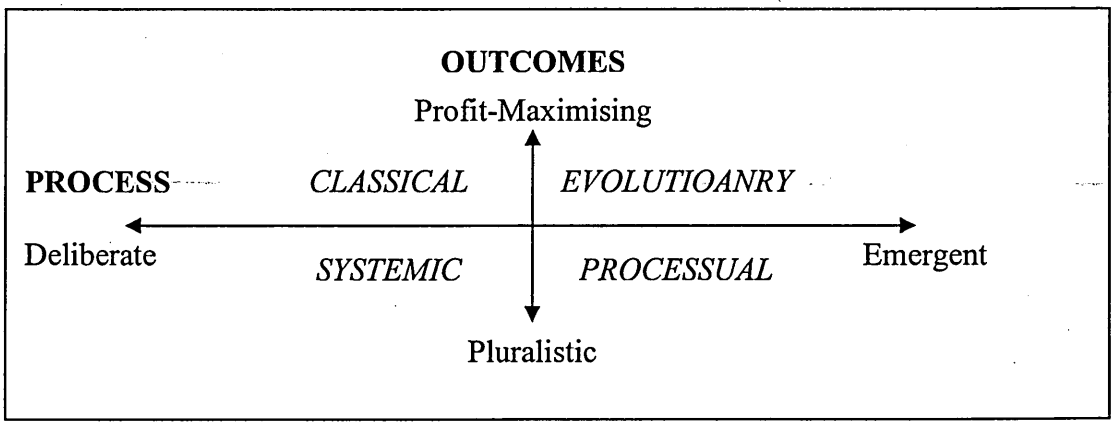

Figure 1-4 Whittington's views on strategy

In a similar fashion to Burrell and Morgan's (1979) *sociological paradigms and organisational analysis* which positions modes of social inquiry between the axes of *regulation-change* and *subjective-objective* Whittington locates approaches to strategy between the dimensions of the strategy's *outcome* (from profit maximising to pluralistic) and its *processes* (from deliberate to unintentionally emergent). Four

quadrants are formed (shown in Fig. 1-4) which Whittington terms: *classical, systemic, processual and evolutionary.*

There is some uncertainty in Whittington's model in terms of the relationship between profit maximisation and evolution (in the biological sense). It seems as though Whittington has adopted the *survival of the fittest* misinterpretation meaning that profit (planned or otherwise) is the criterion for survival. The *processual* quadrant seems to be a closer characterisation of what is herein understood about evolution.

1.2.2.3.3 Aldrich's alternatives

Howard Aldrich (1999), a proponent of the evolutionary view of organisations identifies and assesses six alternative contemporary views of organisations: *ecological,* institutional, *interpretive, organisational learning, resource dependence,* transaction *cost economics.* These approaches have leanings either towards the objective classical analysis or the constructed post-modern interpretation. Though some of these perspectives already allude to evolutionary processes, Aldrich argues that each may provide a contribution to an evolutionary understanding of organisations. The processes that he identifies which result in evolution are *variation, selection, retention* and *struggle.* Though this is similar in principle to Darwinism there is the additional process of struggle.

> Underlying selection pressures and the search for effective variations lies the scarcity of resources within organizations, between organizations, and between populations. Struggle occurs within organizations, as members pursue individual incentives as well as organizational goals. – [Aldrich, 1999 p32]

Aldrich's view of the processes also differs from Universal Selection Theory's *blind-variation and selective-retention* (Cziko, 1995) on the grounds that organisational variation may be either *intentional* or *blind.* In this view intentional rational agency plays a role (ie. formal change programmes or official tolerance to innovation) and variation is not entirely accidental.

A core issue in this process is as to, organisationally, what is being selected. The focus of the evolutionary perspective has changed dramatically since the early attempts of social Darwinism

> Modern evolutionary models of social units are concerned with the *processes* by which these entities change, not with classifying outcomes, as was true of earlier efforts, such as those of E. A. Ross or Herbert Spencer. – [Aldrich, 1999 p35]

Essentially this is the distinction between *doing* and *being*. Here the question becomes as to what an enterprise *does* as a series of practices and activities rather than what an institutional object *is*. The distinction clearly draws attention towards the relationship between behavioural aspects and evolutionary processes (Aldrich, 1999). Two levels of selection have been proposed: (1) routines & competencies, and (2) the organisations themselves. These levels are reminiscent of *The Selfish Gene* hypothesis (Dawkins, 1976), which argues that the fundamental unit of biotic selection is not at the kin or even the individual scope but at the level of competing genes. The selfish gene hypothesis supports the proposition that selection is acting on *routines & competences*. Aldrich elaborates:

> Organizations, then, are the temporary repositories of competencies and routines that are held by their members and embedded in their technologies, material artefacts, and other structures. The distribution of these competencies and routines in a population depends on the selective survival and growth of organizations that contain different combinations of them. Analysis should therefore focus on conditions favouring the selection of routines and competencies, with organizational survival a secondary consideration. – [Aldrich, 1999 p36]

Routines & competencies[55] could be expanded to include other minutiae in the organisational nexus of schemata (Gell-Mann, 1996) including the norms, taboos, language, rituals symbols (Price & Shaw, 1998), and unwritten rules (Scott-Morgan, 1994) that determine the institutions selective inclusive fitness in a particular market landscape (Lord et. al., 2002).

1.2.2.3.4 The Organisational Specie Concept

An organisational classification might indeed relate to the market landscape. It has been noted, however, that there is a lack of sophistication in organisational classification as McKelvey states:

> Organizational scientists have not developed a widely accepted scheme of classifying observed differences among organizations. Nor has there been any development of organizational taxonomy. Instead simple typologies based on one or two organizational attributes...have been offered. ...Because of their simplicity all existing typologies pertain only to limited aspects of organizational behaviour. – [McKelvey, 1978 pp1428-1429]

It has been said that if a formal and scientific classification of organisations existed, there would be no need for contingency theory; biologist do not need contingency

[55] It is as if Aldrich is wanting to use the word 'meme'. It is not clear whether Aldrich was unaware of the term or simply avoiding it for reasons of reputation. Certainly in 2000 (as will be noted later) he makes the link explicit *'Let's take the argument that, in fact, [Susan Blackmore's] right and that is that; let's take routines and competencies as the equivalent of memes.'* http://www.etss.net/

theory (McCarthey, 1998 after McKelvey, 1975). Instead of using simplistic typologies or reinventing the wheel, McKelvey draws upon well-established methods of classification not traditionally associated with the functional approaches adopted by organisational scientists.

> ...over 200 years of experience in biology may offer lessons that apply equally well to organizational classification. There is some risk in adopting the biological metaphor, but there is a reason to believe organizations have much in common with biological organisms. – [McKelvey, 1978 p1429]

From adopting biological metaphor there arises the possibility of an *organisational specie* concept (as analogous to a biological specie) that has been elaborated thusly

> An organisational specie is defined as a *form* of organization which exists through generations of individual organizations which are members of the specie. For a successful organizational classification a specie concept comprised of isolating, ecological and generational mechanisms somewhat analogous to the biological mechanisms may be called for. The application of such a concept implies certain assumptions about organizational forms: (a) That natural selection forces operate to determine which forms will be viable in certain environments and that different environments will lead to different organizational forms (b) That isolating mechanisms exist which serve to preserve organizational forms; (c) That mechanisms exist which pass forms intact through successive generation while still allowing adaptation in the long term as a consequence of environmental pressure. – [McKelvey, 1978 p1431]

Logically, the organisational specie concept allows other ideas that can also migrate across the analogue such as organisational evolution, speciation and so on (McKelvey, 1982; Aldrich, 1999). Though McKelvey only produces a preliminary sketch of a dendrogram which shows hypothetical classes of a then untested theory of organisational difference he does propose a similar ranking scheme as suggested in the current research (§1.1.5.2).

McKelvey draws ideas from numerical taxonomy, as a means of biological systematics (Sneath & Sokal, 1973), although he does indicate the problems of its organisational application (McKelvey, 1975) similar to those encountered in their biological use. Of particular value is the concept of the *polythetic group* whereby.

> ... organisms are placed together that have the greatest number of shared character states, and no single state is either essential to group membership or is sufficient to make an organism a member of the group. – [Sneath & Sokal, 1973 p21]

Or more precisely (McKelvey, 1978; Aldrich, 1999 p36).

> A polythetic group is one where (1) each member possesses many properties, p, of a set of properties, P, (2) each p in P is possessed by many members, and (3) no p in P is possessed by all members

A polythetic group approach to organisational classification is in contrast to monthetic grouping schemes (whereby all members possess the same set of properties)

traditionally used by essentialists and past typologists. Such a classification of organisations then, takes into account the plethora of characteristics (routines, competencies and so on) that can be ascertained and renders populations amenable to numerical taxonomic methodology (Sneath & Sokal, 1973).

The organisational specie concept then may be defined as:

> ... polythetic groups of competence-sharing populations isolated from each other because their dominant competencies are not easily learned or transmitted – [McKelvey, 1982, p192]

It is debatable whether the competences are difficult to transmit in themselves or whether ingrained epistemologies of practice inhibit learning. In explaining the reason for isolation between polythetic groups, McKelvey all but uses the word 'meme'.

> There also seem to be mechanisms isolating the technologies of various organizational species. The difficulty of learning methods peculiar to certain jobs, craft skills, the extensive knowledge of various professions, and management methods peculiar to certain workplace technologies acts as a barrier preventing the movement of core technologies form one organizational specie to another. --- The problem of a generational mechanism analogous to the intercommunicating gene-pool, which allows long term evolution while preserving stability in the short term, may be solved with the concept of a *tech pool.* – [McKelvey, 1978 p1432]

Seeing peculiarity of methods as being the barrier to competency transmission however does not reveal much insight. Unfortunately, the term *tech pool* doesn't convey the principle of replication or collaborative selfishness that *meme pool* does. On the other hand, seeing routines, competences (and other characters) from the memetic point of view is in alignment with the definition of organisational specie as a polythetic group. Different species may (by definition) have different competences at a given memetic locus. As memetics alleles (alternative practices) compete for acceptance then it can be seen how the development of new competences are arrested, how patterns become locked in and how organisations become ossified in their own traditions (Price & Shaw, 1998).

1.2.2.3.5 Organisational Cladistics

Conventional organisational typologies, like the original Linnaean biological system that assumed special creation, classify without consideration of evolutionary processes. Since McKelvey stated that

> There are no examples of evolutionary classification of organizations and hereto-fore organizational typologists have not recognized evolutionary (explanatory, casual) typologies or classifications. – [McKelvey, 1978 p1430]

significant mileage has been gained in adapting biological methodologies for the application of analysing patterns of organisational evolution (McCarthy et.al. 1997; McCarthy, 1997). Cladistic methods (Hennig, 1966) were used to elaborate on untested preliminary sketches (McKelvey, 1978) where upon a pattern of descent in manufacturing systems were confirmed and a cladogram of the automobile construction industry was constructed. Cladistics, in difference to its rival phenetics (Hull, 1988), directly assumes phylogenetic principles (patterns of descent with modification). Unfortunately, accepting phylogeny *a priori* presents certain methodological difficulties (Sneath & Sokal, 1973), and it is the partial aim of the current research to resolve these. One problem is with the ability to construct a cladogram even where no phylogeny is present. Such a situation would construct a pattern of coincidental similarity (i.e. phenetic) that has arisen though some process other than evolution. Applying cladistic methods alone neither demonstrates the presence nor absence of evolutionary processes. So while the method itself may be theoretically sound in biology, its organisational application is debatable without providing an independent demonstration that evolutionary processes are responsible for the patterns that cladistics show. Secondly, even if there is a phylogenetic relationship, and if cladistics does accurately depict it, the method provides no theoretical mechanism to explain how inheritance, variation, selection and other evolutionary aspects are occurring or what is being selected. Thirdly, and in the absence of a mechanism of inheritance, it is uncertain whether Darwinian evolution is occurring or something else. Fourthly, the McCarthy study focussed on the variations in manufacturing technology within a wider organisation and so could only demonstrate evolution of manufacturing technique and not of organisational evolution; it is appreciated that the method could be expanded to cover wider organisational parameters however[56]. Should these difficulties be resolved then cladistics would indeed become a powerful analytical tool. The current research, in attempting to show that memetic methodologies are feasible, also provides a first test for a mechanism of inheritance. In doing so it begins to upholster the *a priori* assumption, and thereby contributes to resolving the difficulties, of organisational cladistics.

[56] More recent application has been performed by Fernandez & McCarthy (2002) and Tsinopoulos & McCarthy (2002)

1.2.3 Contemporary Memetics

> For some opponents of 'memetics' in any guise, the mere idea of it is totally misconceived, whether because (as the Reductionists argue) cultural evolution is really all about the workings of our genes, or because (as the Creationists argue) it's really all about the souls implanted in us by God, or because (as the Post-Modernists argue) no so-called theory of cultural evolution will ever explain it any better than any other so-called theory – [Runciman, 1999][xviii].

Memetics, at the current time, may be said (as with the previously suggested chronology) to have moved into the second era whereby scholars, starting from the mid 1990s, began to recognise the idea's potential. The next decade may see the beginning of a third era in terms of operationalising the theory and finding practical uses. Contemporary memetics seems preoccupied with establishing whether or not the meme has mileage as an academic subject. Proponents of the memetic stance are trying to gather acceptance through the channels of rationalism and theorising[57]. A certain amount of empirical work is however being done in actual memetic research, some of which is in the organisational field of memetics.

1.2.3.1 Acceptance of the meme

As John Dunne[58] put in prose '*No man is an island entire of itself; every man is a piece of the continent, a part of the main.*' It is universally familiar for humans, as social beings, to learn skills from others and to pass those skills on. The basic concept of the meme, using the literary device of a spreading infection, appeals to common experience and is readily accessible to the layperson without recourse to scientific sounding jargon[59]. The popularisation of a faddish theory without adequate theoretical justification places it in the same box as an "wild fringe" and therefore gives it no place at the high table of proper scientific inquiry[60].

Dawkins (1982) had attempted to preserve his own academic respectability by distancing himself from being idolised as the father of the new scientific field. Rather than instigating an encroachment on anthropological and social scientific territory,

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[57] Or, as Giddens would have it, making up "just so stories"

[58] Dunne's Meditation 17 (1623-1624) also makes an interesting allusion to memetic recombination. http://www.imaginary.com/~borg/Literature/Poems/Meditation17.html

[59] I once explained the meme concept to a friend of mine, who the same day explained it to someone on a bus in Sheffield.

[60] As the absence of the M word at the LSE debate shows

Dawkins says that his intention behind christening[61] the meme was to illustrate his argument about genetic replication.

> My own feeling is that its main value may lie not so much in helping us to understand human culture as in sharpening our perception of genetic natural selection. This is the only reason I am presumptuous enough to discuss it, for I do not know enough about the existing literature on human culture to make an authoritative contribution to it. – [Dawkins, 1982 p112]

Released upon the unregulated agar of net culture, the meta-meme spread like wildfire. Like so many other newly colonizing memes, the message became somewhat marginalized simply by the nature of the medium. Towards the mid 1990s a growing number of vociferous pundits began to expound the philosophical importance of memetics (Dennett, 1995; Fog, 1996) calling for paradigm change (Khun, 1962; Brodie, 1996). This can be seen as a transitional time whereby the meta-meme mutated from an intellectual curio into a fully-fledged contender fighting entrenched disciplines for serious academic recognition. However, because of its rather feral heritage, many difficulties needed to be addressed in order to tame the meme.

> The initial description of `meme' by Dawkins is rather vague, as he admits himself, which is a possible reason for current diverging views on what a meme really is, and how the memetic model can be used. We are confronted with an avalanche of books, essays, and publications scattered over different journals and disciplines, with dialogue flashing up here and there in an unstructured manner. Many dialogues disappear after only a brief lifespan. This chaos exists because a general framework is lacking. – [JOM:EMIT[xix]]

Perhaps the most significant step towards acceptance, other than attracting Dennett's eye, was the launch of the *Journal of Memetics: Evolutionary Models of Information Transmission (JOM: EMIT)* in May 1997. This electronic journal set out to resolve some of the more serious issues in memetics by adding some structure to the situation and bringing some respect to the emerging discipline. Although other memetic forums and sites of varying quality existed on the web at the time, the JOM: EMIT attempted to confer kudos and quality by being the first peer-review approved journal by university academics.

In collaboration with the Principia Cybernetica Project, the JOM: EMIT organised the first symposium on memetics, as part of the 15th International Congress on Cybernetics in Namur (Belgium) in 1998. Papers presented discussed the

[61] to mix a metaphor

fundamentals, computers and networks, evolutionary mechanisms and the relationship to the social sciences[xx].

Another sign of the growing acceptance of memetics was a conference held a Kings College, Cambridge entitled '*Do memes account for culture*?' (Aunger, 1999). Discussion revolved around whether memetics contributed anything more to the understandings developed by anthropologists or whether it was an unnecessary distraction. Although Dawkins (1982) had made his caveat about the memes value to cultural understanding, he seems to once again changed tack at the discussion at Cambridge. Presumably, the growing recognition of meme theory means that his acquaintance with it would no longer threaten his respectability.

Many of the arguments concern whether memetics should be treated as an actual science or just as a meaningless diversion from sensibility. Agreed, memetics is to some extent a radical and currently unsubstantiated intrusion upon established academic territories. As Gatherer (1998[xxi]) points out

> Memetics as it currently stands is a strange beast, an unrealistic psycho-epidemiology, laden with neologisms, neither theory of mind nor theory of culture. To make it into a science, we need to move forward into territory already occupied by diffusion sociologists and social psychologists – [Gatherer, 1981]

Indeed, flowing from the analogy that the memetics itself is a *virus of the mind* then the corpus of knowledge can be seen as being infected and its "immunological defences" (Dennett, 1995) against the non-trivial threat of paradigm change (Khun, 1962) are being activated by launching counterattacks on the invading contagious thought (Brodie, 1996). Biologists, anthropologists and sociologists have been provoked into making the most violent reactions as it is in their areas that memetics threatens greatest reforms. Here, various criticisms have been made that the meme is a useless abstraction, that memetics has nothing to contribute to cultural evolution or that culture does not evolve. Memetics, though predominantly deterministic has however begun to make inroads into humanism (Arcaro & Brown, 1999)

Memetics seems to spend a disproportionate amount of time protecting and promoting itself (Fog, 1996), and positioning its theories with relevance and relation to existing fields (Edmunds, 1998). Though rich in theory, memetics leaves an empirical chasm (De Jong, 1999). Paradoxically meme theory, as meme theory rather self-referentially

would anticipate (Fog, 1996), is in danger of *transcending its own threshold of self-efficacy*[62] meaning that it exists solely to justify its own existence. Memetics has been preoccupied with defending the philosophical merits of a science of memetics to buckle down and actually do a science of memetics! As Hull said at the 1999 Cambridge conference (Aunger, 1999)[63] *its time to stop talking about it and start doing memetics.*

1.2.3.2 Main themes of Memetic research

The majority of considered opinions about the nature of memetics have been contributed through the Journal of Memetics and this (along with a few other publications) is the primary source of literature concerning contemporary memetic research. Contemporary treatments of memetics can be partitioned into four main categories that have varying degrees of relevance to the current research Philosophical, historical and definitional aspects; Socio-cultural dynamics; Modelling memetic evolution; and Proto-cultural analysis among non-human species (which will go unelaborated).

1.2.3.2.1 Philosophical, historical and definitional aspects

By far much of the debate on memetics has revolved around the issues of whether memes exist in the first place, if so, what are they and where do they reside? Does the meme theory tell us anything new and useful or is it misleading rehash of failed theories? Rose (1998) neatly encapsulates these issues as four controversies.

The first controversy *is concerned with whether* memes are internal or external and stems from definitional ambiguity between *internal* representations and *external* expression. Rose says that Cloak's (1975) i-culture and m-culture[64] are less confused and perhaps more useful than memes. Gatherer (1998) suggests that Dawkins initial and revised formulations might be called *Dawkins A* (D_A)[65] and *Dawkins B* (D_B) respectively. The D_B view is the internalist view of *Thought Contagion* (Lynch, 1996, 1998; Dawkins, 1993) or *Virus of the Mind* (Brodie, 1996), whereby individuals *have*

[62] The most academic way I could invent to say a meme has turned from being a mutualistic symbiote with its host into a parasite. A more spreadable way is to say it has become a *klingon.*
[63] Paraphrased from memory
[64] instructions in the nervous system & manifestations of instructions as material structures respectively
[65] I shall introduce and use this symbolism for convenience

memes that are transmitted by imitation (Blackmore, 1998). Lynch (1998) takes an extreme internalist view by introducing the term *mnemon*. While D_B has been given attention by meme theorists, Gatherer argues (as does Langrish, 1999) that this view of memetics is retarding the field and that D_A should be afforded serious reconsideration. The problem: D_A is ambiguous while the D_B view of individuals carrying unobservable memes, prohibits empirical study. Gatherer (based on Benzon, 1996) offers a "soft" behaviouralist alternative where observable expressions enable positive inquiry, particularly the present study of organisational routines and competences (McKelvey, 1978; Aldrich, 1999). Marsden (1998) suggests that *social contagion theory* has a long history and is evidence-rich even if theoretically bankrupt in the social sciences; memetics, on the other hand, is *'a body of theory without evidence'* (*ibid*). He (1998) argues that these theories are *two sides of the same coin* and calls for their synthesis into a comprehensive body. Marsden (1998) further argues that the individual perspective is the wrong level of inquiry. While arguments still rage across discussion boards; the hankering for a definition has become a research impasse; perhaps we should adopt Aunger's (1999) reasoning that *'Definitional uncertainties should not stand in the way of progress; it certainly did not in the case of genetics during the first part of this century'*

The second controversy in meme theory (Rose, 1998) is whether or not *memetics is Lamarckian*. In biology, the inheritance of acquired characteristics is now widely rejected, as exogenous influences to the phenotype cannot cross the Wisemann barrier. However, cultural information transfer between brains requires[66] some mediating *phemotype*[67] (Wilkins, 1998) and imitated action necessarily affects the recipients' mental structures (Rose, 1998; Blackmore, 1999). So, while the causal arrow from genome to morph is strictly unidirectional, cultural transmission between brains, via mediating artefact (etc.) bi-directional: *phemotype* affects *memotype*[68]. Affected characters of a mediating artefact may become inherited entailing that cultural inheritance would be Lamarckian rather than Darwinian. This Lamarckian view emanates from definitional controversies between internalist and externalist

[66] in the absence of telepathy (Rose, 1998), the hundred monkey syndrome (Shermer, 1997) or other dubious mechanisms

[67] one posting on the memetic discussion list proposed the use of deliberate centre capitalisation of "pheNotype" and "pheMotype" to visually distinguish between genetic and memetic expressions.

[68] Used to denote the substrate independent code of the meme and used in analogue to the genotype – sometimes called memome (as with genome).

memetic perspectives (Rose, 1998). The D_B "mind viruses" proposition (Gatherer, 1998) enables the bi-directional Lamarckian causal arrow between meme encoded brain and expression (Rose, 1998). The D_A view does not demand rigid partitioning between *memotype* and *phemotype* but rather that "mind, matter, and motion" offer different memetic substrates[69]; under certain conditions, they are interchangeable. Memes no longer leap from brain-to-brain, but flow along media lineage in which brains may participate. Whether this view is Lamarckian, Darwinian or something else has received little attention in the literature. Marsden's (1998a) argument that the *individual is the wrong level of inquiry,* suggests a wider social scope that sheds D_B's anthropocentricity. Rather than a population memetics (Gatherer, 1998), focus is shifted to adherents of ideological clusters[70] that are *persistent in character* but *variant in size* as individuals switch their allegiances. In accordance with neo-Darwinism's prohibition on traits acquisition, then character innovation represents novel cluster formation.

The proximity between theories (§1.2.1) raises the third of Rose's (1998) controversies: is *memetics just a sanitised rehash of sociobiology* (or social Darwinism, or evolutionary psychology etc...) or can the meme contribute a clearer way of understanding culture[71]? Rose (*ibid*) concurs gene-centricity's insufficiency but requires *'the addition of cultural mechanisms where they are necessary in order to accurately describe or explain behavioural phenomena.'* (Rose, *ibid*). Memetics supplements the gene by which to compensate for sociobiology's deficiencies. By definition[72], *memetics is not socio-biology*: postulating the existence of memes implies that it is *not* all in the genes. Darwinian natural selection however, is preserved and arguments against this position involve metaphysical philosophy beyond the scope of this research.

While Westoby (1994) wrote 'Memes share the farmyard with us and it is up to us which of them we let push us around', Dawkins concludes that 'We, alone on earth, can rebel against the tyranny of the selfish replicator' (1989 p201) Rose's fourth

[69] Other options are written, digital storage and so on. Recent memetics list mailings also go so far as to say that genes are just another form of meme.
[70] As Marsden doesn't specifically state this scope then my interpretation (in concordance with the research findings) is offered briefly here. It will be covered in greater detail in part 4.
[71] Although I think the understanding of culture is just a component of what memetics has to offer.
[72] Definitional uncertainties aside.

controversy is whether we can rebel through foresight or are we deterministically predestined. Rose argues that '...[Dawkins] assumed there was `someone' beyond the constructs of the memes and genes who could do the overthrowing.' To say that cultural norms (memes) can bypass instinct (genes) is one thing, but what decides between competing memes? Rose (1998) rejects the notion of some "central executive self" with foresight or rational choice that *'undermines the value of meme theory as an evolutionary process'* and that *'We might as well attribute meme selection to magic'* (*ibid*). While philosophical issues of free will and ethics are outside the current inquiry, invocation of some "higher" selecting intelligence, obviates memetic explanatory power without further contribution. This is a problem with the D_B *virus of mind* view that attempts to distinguish "you" from "invaders" (Langrish, 1999) wherein *'The independent mind struggling to protect itself from alien and dangerous memes is a myth'* (Dennett, 1995, p365). Fortunately theoretical consistency may be maintained without transcending the meme concept. An *epistemic meta-context* (More, 1994[xxii]) is sufficient for cultural selection (also Price 1998, 1999; Price and Shaw, 1998[73]). Memetics[74] would contend that epistemologies, paradigms, and other more abstract philosophical knowledge realms are themselves evolving memeplexes; or *selectemes* in Langrish's (1999) terminology[75].

1.2.3.2.2 Socio-cultural dynamics

In contrast to gene-centric theories that have had limited penetration in the social sciences, memetics, by introducing novel Darwinian arguments, is deliberately trespassing on the hallowed ground of social inquiry. At the same time as arguing for social evolution, meme theorists need to distance the idea from prior theories. Gabora (1997) lists a revision of Darwin's prerequisites for evolution as being: A *pattern of information*; a means of generating *variation*; a rational for *selecting* fit variations; and a way of *replicating and transmitting* selected variants. Accordingly they should also be evident in culture.

Gabora (1997) considers information from a mathematical stance (Shannon, 1948[xxiii]; Shannon & Weaver, 1963) of a system's combinatorial state space. If a social system

[73] The fifth attribute is covered in §1.2.4.2
[74] or at least my view of memetics
[75] my term is *epistememe* meaning epistemological memeplex

is considered within cultural state space, then it is easy to see how the meme, as unit of cultural transmission is a pattern of information. Practical notions of signal error and correction (particularly Hamming's ideas) become relevant to the social research methodology particularly in the mapping and metrication of cultural forms. The simple existence of a cultural information pattern gives no indication of its origins, however it is clear that culture is far from static: there is *variation* in cultural patterns. As Gabora (1997) states '*the bottleneck in cultural evolution is the capacity for innovation.*' So how is this innovation generated? Does culture advance through the enlightenment dream of intelligent rational progress or though a series of cumulative serendipitous blunders? Cultural innovation is traditionally seen as brought about by the special few; much has been written human ingenuity (Koestler, 1964; Dilts, 1994; Dilts, Epstein & Dilts, 1991). Pretti & Miotto (1997), draw attention to the familiar link between creative genius and mental illness; psychiatric pathology, they argue, also provide mechanisms for innovation and cultural evolution. The connotations are that the individual is faulty where deviating from collective normalcy (Brant, 1985; Castelfanchi, 2001) however, the epithet of "delusional" may be seen as maintaining the theoretical, theological, ideological, or political[76] status quo (Rosenhan, 1984; Watzlawick, 1984; Horwits, 1984; Orwell, 1949!) and enforced through power vested in regulatory memes, such as education, psychiatry, law and polity[77]. There is however and espoused premium on creativity which is bounded[78] within the existing presidents – to be sufficiently new but not intolerably so (cf. Toffler, 1970). Tolerance of a certain amount of variety, analogous to a healthy gene-pool, enables not only cultural adaptation but also cultural adaptability (Fog, 1997 after Sahlins, 1960).

Arguably, social impositions (higher-level memes) pre-govern creative direction, acting contraceptive to certain innovations while feeding others. According to Gabora's (1997) third prerequisite, creative variants are selected for retransmission. Gabora (*ibid*) notes *'brains select memes that satisfy biological and cultural needs'.* For situations too complicated for genetically determined instincts then innovated or imitated behaviour steps in and the brain's role is in storage and selection of what is

[76] An extreme example being Soviet psychiatry http://www.geneva-initiative.org/geneva/info/gipinmedia/interview.htm

[77] The present research suggests that the Episcopalian meme (appertaining to the presence of bishops for example within Roman Catholicism) is regulatory to others within the memeplex.

[78] A '*significant and original contribution to the body of knowledge*' within the regulations of academia is an example.

appropriate. By analogy to alleles then generated or acquired '*allomemes*' (Durham, 1991) compete for selection by the brain for space. Allomeme selection reflects Rose's (1998) fourth controversy: whether some "central executive self" chooses, or the epistemic meta-context (More, 1994) inured by preceding memetic encounters is determinant.

The final prerequisite for cultural evolution is that selected variants spread through a population. Social science has noted patterns under the guises of *social diffusion*, *social epidemics,* and *social contagion*. In line with Darwin and Dawkins, memetics' preferred term is *replication*; the relationship between memetics and social contagion has been covered by Marsden (1998). The contagion view of the memetic stance has its basis in the "virus of mind" model (see the first controversy) and enables explanations for the spread of non-rational behaviours in terms of fitness of the behaviour itself. Examples include religions and cults (Dawkins, 1993; Lynch 1996), scripture (Pyper, 1997), Usenet content (Best 1997), management practices (Price & Shaw, 1996; 1998), consumer behaviour (Brodie, 1996) and the *Werther effect* of suicide contagion (Marsden, 2000b, 2001).

1.2.3.2.3 Modelling memetic evolution

The third main strand of memetics, as categorised here, concerns attempts to identify the components & dynamics of memes and to form & apply mathematical models. This area is directly relevant to the current research for encoding and analysing organisational characteristics. Edmonds (1998), notes that memetics is open to outside influences leading to healthy variation in memetic models but points out the current uncertainty over what constitutes a good memetic model. He suggests that inclusion in a complete explanatory chain from theory to phenomena will determine their utility.

Langrish (1999), like Gatherer (1998) argues that, by ignoring Dawkins' original formulation of a second evolutionary process, viral models (Lynch, 1996; Brodie, 1996) impede memetics. To overcome this, three broad non-viral types of meme are identified: *recipemes* are competing ways of doing things, which may be compared to

Price's *technomemes*[79] or the work of McCarthy et. al. (1997); *selectemes* are competing ideas of "betterness" that provide frameworks for selecting recipemes and resemble the *value meme* concept (Beck & Cowen, 1996); and *explanemes* are competing accounts of why things work and, at a higher level, are related to *epistememes*[80]. Whereas *recipemes* may be transmitted by imitation (e.g. Blackmore, 1999) *explanemes*, to tell their particular narrative, require some specialised mediating symbolic language. More importantly for the academic study of organisational memetics, Langrish has associated explanemes with the formation of institutions. Institutionalised explanemes can be interpreted not only as abstract competing "schools of thought"[81] whereby adherents engage in a given conversation, but also as organisations (as they are commonly understood) that maintain a given rational of practice. The Christian church, with its own special symbolism, terminology and ritual, for example, is based upon reasoning from theistic premises.

Wilkins (1998) proposes a close and strict analogy between biology and memetics, arguing that shifting from the narrow focus on vertebrate animal evolution that gives rise to apparent disanalogies, would enable perception of general evolutionary properties of both domains. Similarly, Price & Lord (2000) have conjectured an isomorphic proposition (Tsoukas, 1991) between the *biota* and *abiota*. In both cases, the proximity of biology to memetics has indicated methodological translation. Aspects of this translation, owing to its centrality to the current research, are relevant to part 2. Lynch (1998), in difference to Wilkins (1998), relanguages core memetic concepts to emphasise dysanalogy to biology; introducing *mnemon* (referring only to memory abstractions without their expression), Lynch takes a particularly internalist perspective. He attempts an algebra for representing host populations and diffusion dynamics but unfortunately is lost in clumsy grammar, especially as readily applicable notations exist. Best (1998) accuses Lynch (1998) of misusing mathematics and of doing damage to the memetic research program. Lynch (1998b) points to the suspicion that scientists hold for fields without mathematical expressions. Moreover

[79] Price used this term express the idea of a *phylum* of memes of technique on the memetics discussion list 1997 http://aldebaran.cpm.aca.mmu.ac.uk/~majordom/memetics/old/0238.html

[80] My suggestion (http://aldebaran.cpm.aca.mmu.ac.uk/~majordom/memetics/2000/5717.html) that epistemologies are evolving memetic entities (meta-evolutionary epistemology) the meta-meme can be viewed as an epistememe.

[81] Perhaps a school of thought has similar dynamics as a school of fish

he suggests that Best's statement may discourage people from pursuing mathematical investigations.

Ignoring the argument between Best and Lynch, Kendell & Laland (2000) take models from cultural evolution and gene-culture co-evolutionary theory (Cavalli-Sforza & Feldman, 1981; Boyd & Richaerson, 1985; Feldman & Laland, 1996) and introduce them into memetics. They argue that despite technical and linguistic differences, the two disciplines have similar goals.

> Part of the excitement generated by the memetics movement surely reflects the fact that the meme concept by its very existence operationalises culture, breaking it down into the kind of discrete packages that can be subject to scientific enquiry. We believe that mathematical analyses, using cultural evolution and gene-culture co-evolutionary models, can be profitably employed in restricted domains, where cultural traits or memes are easily defined and quantitative studies are possible. – [Kendal & Layland, 2000]

They formulate an example to illustrate how hypotheses, such as Blackmore's idea of imitation advantages, may be theoretically tested using mathematical population genetic methods.

1.2.4 Organisational memetics

Previous sections have covered historical and contemporary themes relating to memetics. Here the central topic organisational memetics is considered as this points directly to the research question.

1.2.4.1 Memes into management

As detailed previously, Tsoukas (1991), following Morgan (1986) suggests greater rigour in the organic model of organisations while Aldrich (1999) has covered the principle of organisational evolution. McKelvey (1978, 1982) has introduced the organisational specie concept along with a classification schemata based upon routines & competences. McCarthy et. al. (1997) have produced cladograms of manufacturing methods. None of these however, make reference to the meme concept although Aldrich (2000[xxiv], following Blackmore, 1999) later makes an explicit connection between routines & competences and the meme as the fundamental unit of selection in organisations.

> Let's take the argument that, in fact, [Susan Blackmore is] right and that is that; let's take *routines and competencies as the equivalent of memes*. Humans, decisions, strategies, all those things become not our focus anymore. Those are all, again, simply ways in which routines and competencies make copies of themselves. It's a fairly radical way of

> thinking about selection logic. It means that if we truly focused on routines, competencies, practices, we would NOT follow people anymore in our research. We wouldn't follow people anymore, we would follow how competencies spread, replicate, and insinuate themselves into organizations. People would sort of disappear from our equations. [emphasis added]

Polythetic grouping upon different sets of routines & competencies when equated with memes certainly supports McKelvey's (1978) organisational specie concept[82] by suggesting a plausible evolutionary mechanism for inheritance and differentiation among organisations.

While Campbell (1960, 1974) had considered evolutionary epistemology, Price (1995 and later Price & Shaw, 1996) viewed organisational learning as a selection process and draws direct inferences from biological processes and particularly to the work of Dawkins (1976). Price (1994) draws a parallel between self-serving unwritten rules (Scott-Morgan, 1994), and DNA in order to suggest that '*companies are creatures of their memes in the same way that organisms are creatures of their genes*'. Langrish (1999), in his three-way typology has made a similar connection between *explanemes* and institutions.

For *organisational memetics* (Price, 1995) then, components of an enterprise's culture[83] such as routines, competences, knowledge, unwritten rules, taboos, norms, traditions, structures, explanations, epistemologies of practice and so forth are conveyed as fundamental memes units. As price (1997) puts it *'Until some such shared pattern emerges, ... no organisation exists.'* This is the "corporate DNA" (Baskin, 1998) that has the *phemotypical* (Wilkins, 1998) expression as an organisation.

The memetic stance clearly supports evolutionary perspective of organisations and strategy (Whittington, 1993; Aldrich, 1999) and by providing a candidate mechanism of cultural variation, selection and inheritance (Gabora, 1997). Obviously, memetically mediated *autopoisis* (Maturana & Varela, 1980) is a radical departure from classical management theory's notion of rational design. The issues are then, how does meme theory explain change and persistence in organisational forms and is there any empirical method of demonstrating this?

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[82] It also equates McKelvey's *tech pool* with the idea of a *meme pool* analogous to a gene pool.
[83] The term *organisational culture* is perhaps used here in a broader sense than normal

1.2.4.2 Organisational persistence and change

Speel (1997) defines *'Institutions are rules stipulating which specific actors have the power to make decisions'* while De Jong's (1999) shifts from power to coping in defining institutions as *'rules which enable actors to cope with uncertainty when making decisions'*. Notably both definitions are closer to Langrish's (1999) *selectemes* than *explanemes* in that that institutions act as an information filters that allows certain dominant arguments to be expressed and discussed while 'recessive' ones are latent.

Similar to Frank's (1999) view that investment memes has little or no correlation to economic soundness, Vos & Keller (2001) discount the rational of wealth enhancement & efficiency behind corporate mergers and acquisitions because of appallingly poor levels of success. A more tenable account, they argue, is that those memeplexes that purchase management power through imperialism increase their own replicative ability.

In suggesting that a meme is the component of language which maps a single organisational feature Giroux, Taylor & Cooren (1998[xxv]) go on to posit that organisations are *'discursively realized phenomenon'*. Interestingly, their starting point is with Giddens' *structurational hypothesis* that replication of the organizational pattern enables it to persists over space & time.

Price & Evens (1993) reflect upon their industrial experience, drawing from biological theory, to suggest that organisations change, not through *gradualism* but through *punctuated equilibrium* (Eldredge & Gould, 1972) whereby long periods of stability are punctuated by environmental catastrophe and radical change. Organisationally, the tendency is towards stability and tradition of underlying mental models and memes replicate themselves. Organisational change occurs in accordance to shifts in memetic or mental patterns (Price, 1997; Price & Kennie, 1997).

Building upon Price (1994), Price & Shaw (1998) consider *Shifting The Patterns* of limitation in which management become entrapped. They note the self-propulsion within the fad industry and that silver bullets and miracle cures often, once the initial

novelty has worn off, fail dismally. The reasons for this, Price & Shaw argue, are ingrained patterns: urgency, being "fixed" and abdicating responsibility[84]. Of course, any cycle of quick relief addiction (Senge, 1990) is all very profitable for drug-pushers, pharmaceutical giants, "management guru's" or other "fad vampire's[85]" who have a vested interest in the problem's perpetuation and propagation.

More importantly, Price & Shaw's (1998) equation between patterns of management and memes makes pertinent Dennett's (1995) question *'cui bono?'* Adopting the *selfish-meme's eyes view* reveals the source of change resistance. Not only is the organisation an expression of the meme but also is the machinery for the meme's replication. A replicator conveys sameness, so from its "perspective", high fidelity maintenance of the status quo is a matter of self-preservation and so a "successful" corporate meme is one that has acted as an *'invisible antibody to change'* (Price & Shaw, 1998 p139).

Memes that inhibit change may be in contention with the demands of a turbulent environment thereby posing a threat to the organisation's very existence. It is not enough to merely see limiting patterns but also to be able to shift them to empowering ones[86]. Price & Shaw (1998) mention four parallel attributes across the isomorphism (Price & Lord, 2001) that provide clues towards memetic health.

i. Flexibility through minimum specification
ii. Diversity and variety
iii. Isolation and interconnection
iv. Pattern shifting capacity

The commonality is *evolvability,* by analogy to the genetic capability for evolution, confers an innate ability to adapt (Sahlins, 1960). Price (1995) points to the flaw within the classic icon for "the survival of the fittest":

> The cheetah, fastest of all land animals, is the most specialised, leanest and fittest member of the cat family. It is also a genus of its own in that family and it possesses less surplus genetic material than other big cats. The genetically lean cheetah "strategy" has proved far less adaptable than the more genetically diverse mainstream gene of the lions, tigers, leopards and wild cats – [Price, 1995].

[84] Watzlawick et. al. (1974) note similar patterns in psychotherapy & the failure of 1st order change.
[85] as phrased by Michael Doyle of Meme Works (private communication)
[86] Several practical intervention techniques are discussed which have distinct analogues in psychotherapy. Unfortunately, how they work is not covered from a meme theoretical perspective.

Sharing this fitness ideal, initiatives like *Six Sigma* or *Lean Production* seek to eliminate *muda* in order to improve value (Pyzdek, 2000[xxvi]). Fitness does not equate to health and overspecialisation becomes an evolutionary straightjacket[87]. Adaptive designs carry excess genetic capacity, which gives them an escape route for when their world changes. Correspondingly, provision of requisite mental variety may be derived from enabling different conversations in organisations – acting like gene-shuffling *transposons* (Price, 1994).

Price & Shaw (1998) argue for a *fifth attribute* that has no naturally occurring equivalent.

> As a species we alone have grown beyond our biological inheritance, *we can also grow beyond our cultural inheritance.* – [Price & Shaw, 1998 p313]

This concerns leadership in the sense of intentionally going above and beyond limiting patterns and moving closer to the edge of chaos.

Marsden (1998b) raises a few issues regarding Price & Shaw's (1998) *'unorthodox understanding of the relationship between meme and organisation'* and points to the problems with the disanalogies between organisations and organisms[88]

> Organisations are not physically bonded, rather relations between their constituent parts are informational: Organisations themselves do not reproduce whereas organisms do: Unlike organisms, organisations have phylogenies: Companies do not have any needs themselves, unlike organisms. – [Marsden, 1998]

Price & Shaw (1999) reply

> ... extended phenotypes are not physically bonded neither are, say, symbiotic organisms co-evolving, yet replicator theory explains the resultant complex order. Second organisations, or at least organisational strategies and processes, are very definitely reproduced through imitation. Third McCarthy et. al. have demonstrated organisational phylogeny and introduced the prospect of the twin sciences of organisational memetics and organisational cladistics. Finally, while companies may start as vehicles to deliver individual needs we would argue they become institutions with, in a sense at least, their own - or their memes' - needs. Who in an organisation has not heard the expression 'what this organisation needs is ..... – [Price & Shaw, 1999]

Indeed the current research undertakes to at least explore these issues.

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[87] As McCarthy said at the 2002 conference of the Manufacturing Complexity Network (paraphrased from memory) 'the British supermarket supply chain may be the leanest and most efficient in the world but it is killing us'

[88] I suspect the line reading 'Unlike organisms, organisations have phylogenies' was intended to be the other way around.

Marsden goes on to make a few other minor criticisms before hitting one of the central controversies of memetics (Rose, 1998) saying that Price & Shaw *'promote a velvet revolution in corporate culture'* where managers are able to *'rebel against the tyranny of selfish replicators'* (Dawkins, 1976). Free will, choice and determinism, as philosophical abstractions are an interesting aspect of memetics. Crossing the gulf between academia and practical management, such "rebellion" becomes a critical point and Aldrich (1999) point to how a manger's would view such an issue.

> Managers, almost by definition, believe that most of what they do is *not* blind; they assume that they can use their skills, when faced with uncertainty and risk, to improve their situations – [Aldrich, 1999 p25]

Of course a purely deterministic book aimed at decision makers would be meaningless (and un-saleable!) and Marsden, in stating that *'homuncular-speak sits uneasily with meme theory'* suggests that the Price & Shaw may have stated their case more clearly by employing existing non-memetic theories. The authors contend however that dualist homunculi are unnecessary as there are memetic patterns that permit inquiry into other memetic patterns. Based on this argument, Price (1999) takes a more philosophical perspective and observes that:

> Indeed, finally abandoning any self outside memes and genes seems to demand more, not less, self awareness.

1.2.4.3 Most recent directly related research

Methods of organisational cladistics (McCarthy et. al., 1997) have more recently been applied in electronics manufacturing (Fernandez & McCarthy, 2002) and methods of drug discovery (Tsinopoulos & McCarthy, 2002)

Price & Lord (2000) had suggested an isomorphic proposition between biota and the abiota (for terminology see §1.1.5). This offered the translation of biological methods across to the abiotic domain. Lord & Price (2001) demonstrated the validity such domain transfer by applying phenetic methods for the reconstruction of phylogeny of western Christian denominations. A further demonstration of method was performed upon players in the Facilities Management field. (Lord, Lunn, Price & Stephenson, 2002). These papers are direct components of the current research and will be detailed in relevant parts of this volume.

1.2.5 Summary of Literature

The strands of thought spanning from primal myths of supernatural cosmogonies to recent speculation around social systems as evolving complex adaptive systems splits and intertwines many times, but finally comes to full convergence when the organisational "gene" is introduced.

The enlightenments rejection of dogma and blind faith in exchange for modern, progressive, rational science paved the way for Lamark, Darwin, Wallace, and their contemporaries, to speculate evolutionary accounts for species; although the likes of Spencer and Galton considerd social implications, the confusions and agendas presented Social Darwinism as justification for racism and atrocity. While the new-synthesis corrected many misconceptions for biology, evolutionary theory upon sociology was tarnished; socio-biology suffered but evolutionary psychology attempts to steer clear.

New twentieth century working practice attracted scientific approaches to management. Subsequent studies lead to the recognition of the importance of social factors. Later, organisations became viewed from the perspective of systems theory. More recently, organisational theory has abandoned reductionist principles, drawing instead upon post-modern perspectives of society and culture.

Tarde's *imitations* had faded into obscurity long before Dawkins and *the selfish gene.* Definitional ambiguities, fringe associations, and a methodological void arrested the fecundity of meta-meme and it took nearly two decades to gain serious academic recognition. Although riddled with controversy, the meme promises explanatory power for socio-cultural evolution. On the other hand, complexity principles resurrected thoughts around social self-organisation and natural selection; teamed up with the meme, a science of organisational evolution becomes coherent without the taint of social Darwinism. While theoretical space is being explored, it is being left empirically unfulfilled for want of methodological maturity. The role of the present research is to provide evidence that such a methodology is possible; part 2 proposes a test.

Part 2: Towards the Development of a Memetic Methodology

We can scarcely imagine a problem absolutely new, unlike and unrelated to any formerly solved problem but, if such a problem could exist, it would be insoluble. In fact, when solving a problem, we should always profit from previously solved problems, using their result, or their method, or the experience we acquired solving them. Hence the question: *do you know of a related problem*

- How to solve it: George Polya (1957, p98)

2.1 Methodology Introduction

If we were to accept memetics in its epistemological capacity, it would peel away the altruistic façade of knowledge to expose its selfish core. This sceptical slant gives us the ability to challenge accepted truths and envisage the possible existence of alternative *explanans.*

Any newly emerging strain of scientific thought, *en route* from daydream to established fact, has to run the gauntlet of criticism. The evolutionary mechanisms described by the philosophy of science selectively weed out spurious ideals and preserves legitimate claims that do carry substance (Hull, 1988).

Evolutionary biology and organisational theory, despite crossing paths on several occasions, have historically managed to maintain mutual segregation by prohibiting theoretical hybrids. Complexity, neo-Darwinism and memetics challenge this self-serving dichotomy. By providing a dysteleological minimal heuristic by which organisations can arise, there is motion towards theoretical unification. Furthermore, and on a pragmatic note, the memetic stance on organisational maladjustment is promising in terms of corrective intervention (Price & Shaw, 1998).

The introduction of a second, non-genetic, replicator is producing an explosion of socio-cultural hypotheses and it is the role of science to determine which endure. As part 1 saw, memetics is currently theory laden as opposed to being an empirical science; the role of the current part of the research is to exemplify such maturation's feasibility. A method of evidencing the presence of an organisational inheritance mechanism may be constructed by building upon contemporary theory. Application of the method to empirical evidence is tested in part 3.

2.1.1 Objectives and structure of this section

As part 1 showed, the current research has an extensive and eclectic and, in terms of memetics, almost exclusively theoretical, background. Having identified the yawning empirical gap in organisational memetics, this section concerns itself with the first part of the core objective: seeing whether or not a memetic methodology is possible, by attempting to build a prototype.

The, existing literature contains the foundations upon which the method can be build; these cover among other things, the epistemology, the means of modelling and other assumptions used in constructing a methodology and later selection of the test case. A key supposition is the *isomorphic proposition* drawn between the biota and abiota as this enables justification and clarification of, the *organisational "gene" hypothesis* and also suggests domain translation of appropriate biological methods.

Secondly, it is important to know whether or not the method works; validation criteria require setting whereby the uncertain method can be compared to a known quantity. The specific stages and techniques of the proposed process can then be described in sequence along with specific methodological difficulties that may arise.

Owing to computational complexity of the method's *implementation* could only be achieved practically through computerisation. Implementation is covered here (and in more detail in appendix C).

2.2 Premises and assumptions

In the vast corpus that surrounds this research there are many, varied, often conflicting, concealed or confused assumptions. In order to present a coherent method, the selected assumptions are explicitly stated and clustered according to their source.

1. The epistemological and ontological premises that underpin the methodology and subsequent assumptions.
2. Metaphorical models of organisations are viewed. Particular emphasis placed on the organic analogy, as this is one of the key starting premises in developing the both the organisational "gene" hypothesis and the memetic methodology.
3. A simplified model of biotic evolutionary concepts and processes.
4. Systematics, cladistics and numerical taxonomy concepts are covered to show how attempts have been made to reconstruct evolutionary patterns within biology. These offer pointers towards the development of the method.

2.2.1 Philosophical Stance

2.2.1.1 Metaphysics and epistemology

Social systems have evaded natural understandings and the question of what organisations are remains open. Can organisations be classed naturally? The starting point of this question is natural science. This relates to the metaphysical theory of naturalism, which holds that all phenomena can be explained mechanistically in terms of *natural* (as opposed to supernatural) causes and laws. The Sceptic's Dictionary[i] says that

> Naturalism posits that the universe is a vast machine or organism, devoid of general purpose and indifferent to human needs and desires

Related to this is *dysteleological* aetiology, which rejects the premise that natural events are *intentional*; rather, events are results of antecedent blind natural forces.

With roots in the natural sciences, this work leans upon positivism not merely because of its evolutionary orientation but also by Comte's ideas about classification and development of human thought. Further, positivism has been used to refer to the unity

between natural and social sciences and has echoes in social Darwinism and socio-biology.

Postmodernism (after Toynbee, 1939) and the abandonment of the scientific pursuit and technological conquest of nature's absolutes, has made its presence felt (particularly in the social sciences) and perhaps this experience gives positivism the opportunity to mature into *neo-positivism*[1]. This term requires explanation. The *positive* values are upheld: evidence over opinion; reason over dogma; and sense over superstition. The *neo* prefix infers a variant on positivism: not strictly in an original naïve realist, progressive, objective sense as characterised by Newtonian physics. Consequently, pragmatic and rigorous science can be conducted while acknowledging the context of, but un-distracted by, relativism's caveats.

Dawkin's idea of the meme is a rational extrapolation from naturalism to culture that has spawned a body of theory that invites a positive treatment. Memetics, however, is a fledgling epistemology in its own right and has peculiar relationship with postmodernism[2]. Constuctionism sees knowledge as a social construction; similarly knowledge, viewed as evolving selfish replicator (Gabora, 1997; Cziko, 1995) and as Tarde's *extra-logical influences* would suggest, has no necessary connection to objective "truth"[3].

Moreover, the meta-meme's acknowledgment of its own selfish viral nature raises certain Russelian paradoxes that are beyond the scope of this discussion[4]. For the purposes of this research epistemological emphasis is placed on the positive aspect: it is about a *science* of memes and of social organisation; the Latin etymology of 'fact', should be borne in mind at all times[ii].

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[1] Although this term has been associated with the Vienna Circle and is closely related to logical positivism, that use had an abstract philosophical orientation. Here I prefer to give a meaning to neo-positivism that is associated with the philosophy of science.

[2] And Price (private communication) has described '*memetics as postmodernism red in tooth and claw!*'

[3] Although purporting to be true within an environment where "truth" is valued would increase a particular meme's fitness along with the fitness of the "truth" memeplex.

[4] Perhaps therefore, *pan critical rationalism* (More, 1994) offers an epistemic meta-context in which symbiotic memes can be cultivated using the instruments of natural science.

2.2.1.2 Homomorphism

A characteristic of the natural sciences is their aim in producing rigorous models[5] therefore a naturalistic science to organisations would consider a rigorous model of such. The process of modelling produces a representation[iii], which in mathematical terms is related by *homomorphism* whereby some aspects of the phenomenon being modelled are deleted or distorted. Different assumptions to modelling will produce alternative representations or *homomorphs*, as different types or amounts of information will be lost (Fig. 2-1). Some homomorphs are more representative than others and it is the role of methodology to suggest which are which. Progress in explaining biological phenomena, from superstitious creation myths through to neo-Darwinian evolutionary theory, illustrated this point (in part 1). The role of this current research is to test a memetic methodology, which entails a rigorous naturalistic model of organisations. The specific relationship between biology and organisations will be investigated later; an abstract approach to modelling using mathematical logic is treated here.

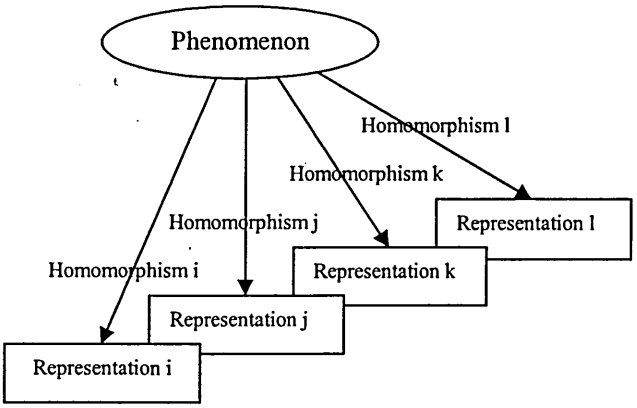

Figure 2-1. Alternative homomorphs

Starting with metaphorical *abductive* reasoning[6], from the all the possible explanations for an observation, the more plausible are worth pursuing. To exemplify: Observations of phenomenon (A)[7] suggest an array of competing representations[8] (i.e. homomorphs) yet a scientifically rigorous model remains to be developed. However,

[5] model and theory are taken here to mean the same thing

[6] Abduction plays the role of generating new ideas or hypotheses; deduction functions as evaluating the hypotheses; and induction is justifying of the hypothesis with empirical data. The methodology of the research follows this pattern.

[7] Although the example is intended to be abstract, A could be read as Abiota while B is the Biota as this is what they later refer too.

[8] Taking a homomorph as a meme then competition becomes based on fidelity, fecundity and longevity.

there may already be some other phenomenon (B) that has tried and tested rigorous model (B_r) and from which inspiration can be drawn (Polya, 1957). Noting that one particular model (A_k) resembles B_r then this may help formulation of, or at least speculation about, a rigorous model A_r for phenomenon A. From here (Fig. 2-2) we can begin to develop upon the most promising homomorph of A using scientific methods (Tsoukas, 1991).

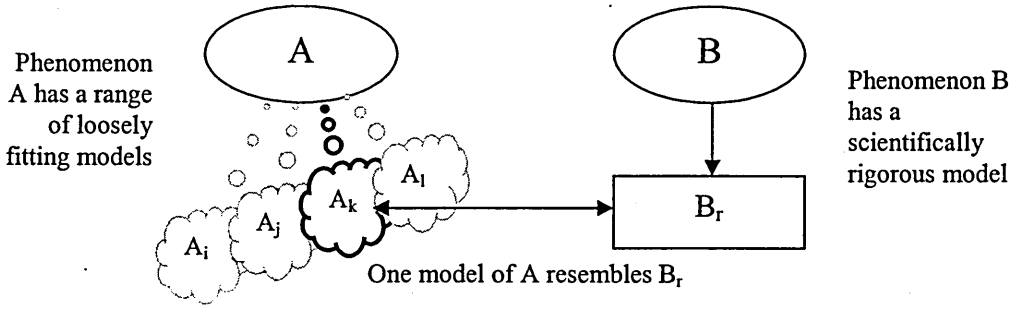

Figure 2-2. Developing a promising homomorph

2.2.1.3 The isomorphic proposition

It is possible to contrive homomorphs (for two phenomena) that are isomorphic[9] (see Krippendorff, 1986[iv] for definition of isomorphism). However, where the models hold resemblance, yet the phenomena are very different, then one or both of those models must be poor. On the other hand, where the phenomena are in proximity and one of their models is known to be reliable then it likely that the other model is also[10].

The methodological value of homomorphism and isomorphism arises through what Price and Lord (2000) termed the *isomorphic proposition* (Fig. 2-3) that, for the sake of argument, proposes that the models are the same. Continuing from the example above, assuming that we are now speculating about a rigorous model A_r; the loose model A_k has resembled B_r therefore phenomena A can be approximated to B. We can now propose a *new model, A_r is isomorphic to existing model B_r*. In doing so we presume that A_r has been generated with the same rigour as B_r (by the same methods).

[9] *Isomorphism* is a special case of homomorphism where no information is lost – the two models are structurally identical and interchangeable.

[10] A mathematical ideal would be where the phenomena were identical and perfect modelling achieved a loss-less homomorphism – the isomorphic relationships between phenomena and models would constitute an *equivalence class*

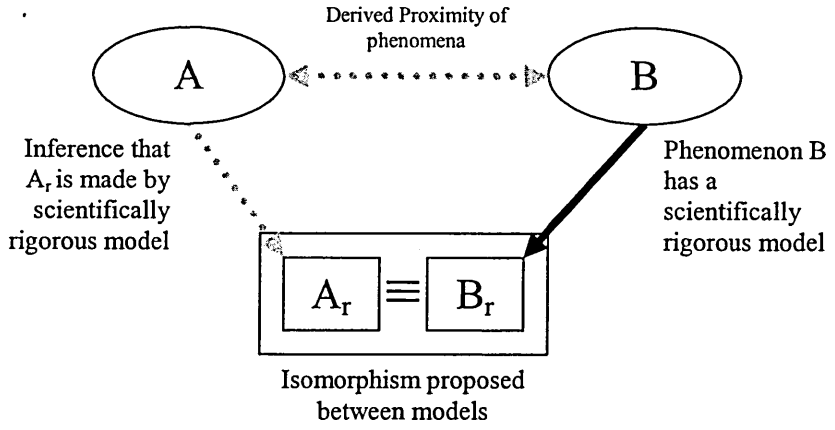

Figure 2-3. Making an isomorphic proposition

The isomorphic proposition doesn't so much require proof in itself but rather it offers a starting point for building a better model of some poorly understood phenomenon. Its first strength is in generating a series of hypotheses (constituents of A_r) by translating B_r; one of which the organisational "gene" hypothesis. Its second strength is that, because it also translates proven methods, then there is a means by which each individual hypothesis may be tested (Fig. 2-4). It will be shown how phenetic methods are may be applied to the abiotic domain. First the problem of organisational homomorphs will be considered. Then evolutionary processes and biological taxonomy, as constituents for translation will then be detailed.

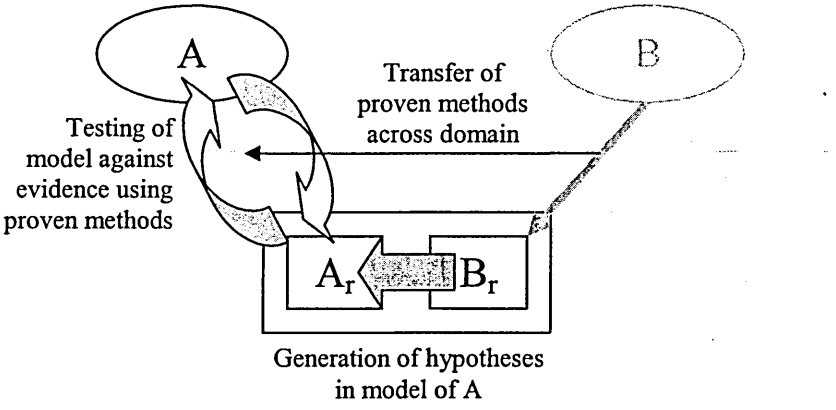

Figure 2-4. Generation and testing of hypotheses using the isomorphic proposition

2.2.2 Organisational theory

Central to this research is the question of *what are organisations?* Although the process of '*organisation*' indicates a structuring, within the context of management and business an organisation is taken to mean *Complex bureaucratic organisation* (Etzioni, 1961; 1964), corporation or enterprise. Here however, a more abstract

working sense of *any social grouping with a discernable order* is provided as this assists understanding without predetermining the result. Perhaps the best exemplars are where people form groupings by some common "purpose" although other forms are to be borne in mind and teleology is not implied. In any ensuing text where greater specification is required, the word organisation will carry a relevant adjective.

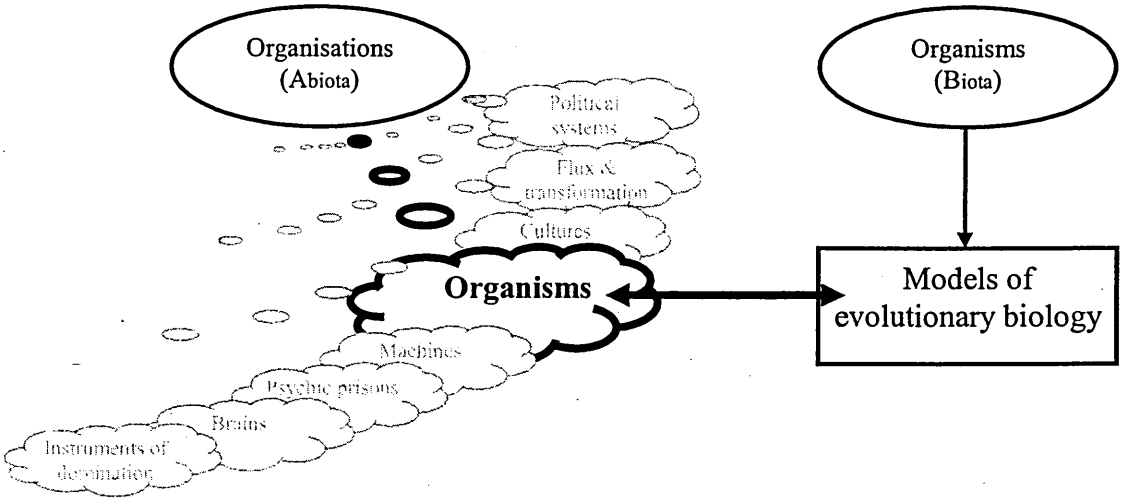

Figure 2-5. Images of organisations as homomorphs

In attempting to understand what organisations are Morgan (1986) suggests

> ... that all theories of organization and management are based on implicit images or metaphors that lead us to see, understand and manage organizations in distinctive yet partial ways ... The use of metaphor implies *a way of thinking* and *a way of seeing* that pervade how we understand our world generally – [Morgan, 1986 p4]

But that

> We have to accept that any theory or perspective that we bring to the study of organization and management, while capable of creating valuable insights, is also incomplete, biased, and potentially misleading. – [Morgan, 1986 p5]

Models, theories, images and metaphors of social organisations, are just representations of predominantly intangible, complexed entities consisting of people, property, knowledge, routines, competences, practices, stories & traditions, tangled social relationships, emotions, ambitions, fears and so on. As models are homomorphs they delete, distort & generalise; various organisational models that focus on differing aspects. Morgan presents several *images of organisations* (machines, organisms, cultures, brains, political systems, psychic prisons, flux and transformation and instruments of dominion; Fig. 2-5) with the intention of providing alternative metaphorical viewpoints and while there are overlapping elements focussing on one does not deny the value of another. From the point of view held here though, the

issue is with *logos* rather than *mythos* (Røyervik, 2000) and thereby with conferring the rigours of natural science to organisational theory (Tsoukas, 1991). Although it might be possible to draw up an isomorphic proposition for each of the metaphors[11], abductively the prime candidate, and the one perused here, is the '*organisations as organisms*' variant. A few common and intuitive observations give rise to this speculation:

(a) *Organisations exist in marketplaces (and environments):* Although competitive commercial activity operates in marketplaces a wider conceptualisation is beneficial and non-commercial arenas of activity should be acknowledged[12]. The market is widely regarded as one element of a complex interplay of environmental factors which include those which are economic, technological, legislative, demographic, cultural and so on. Many different kinds of market places exist supporting different industries and institutions.

(b) *Organisations have traits:* Characteristics commonly considered by management studies are the organisation's structure, which includes the division of work, headcount, authority, order, location. Organisational behaviour also contributes characteristics such as routines & competences (McKelvey, 1978) rules & procedures, practices, efficiency, quality, revenue among other classic definable parameters (Khandwalla, 1977; Hrebiniak, 1978). Along with these are intangible sociological parameters such as: taboos, subcultures, traditions, epistemic practice and '*unwritten rules of the game*' (Scott-Morgan, 1994).

(c) *There is a diversity of organisational forms:* Clearly, many there are a diverse range of organisations, governmental, commercial or otherwise. This *commercial diversity* is differentiated by their traits.

(d) *Viability is governed by organisational traits and market forces:* Organisations are transient; there is a time of their inception, and a time of their ultimate demise. Their success is a contingent relationship between what they do in the face of market forces, technological developments, competition (and so on) and through investment in adapting to meet with changing environmental pressures (Emery, & Trist, 1965). An organisation's viability and therefore its continued existence, is influenced by its structure and behavioural response to the pressures of the marketplace. The organisation (particularly commercial) that has some character

[11] Price (1999) argues substance of other non-mechanical metaphors within the memetic stance.
[12] Such as faith groups competing for adherents shown in part 3.

that provides it with a competitive edge has more favourable chances of continuation than its rivals.

These simple observations, in accordance with the *'organisation as organism'* metaphor, have clear biological analogues (Fig. 2-6) between:

(a) the marketplace in which an organisation competes and the environment of animals and plants;

(b) structural & behavioural organisational traits and organism's phenotype;

(c) commercial diversity and biodiversity and

(d) an organisation's economic viability in the face of market forces and natural selection acting upon an organism's fitness.

Given these analogues then there is reason to pursue the isomorphic proposition with a more rigorous biological model, which will be presented in the next section.

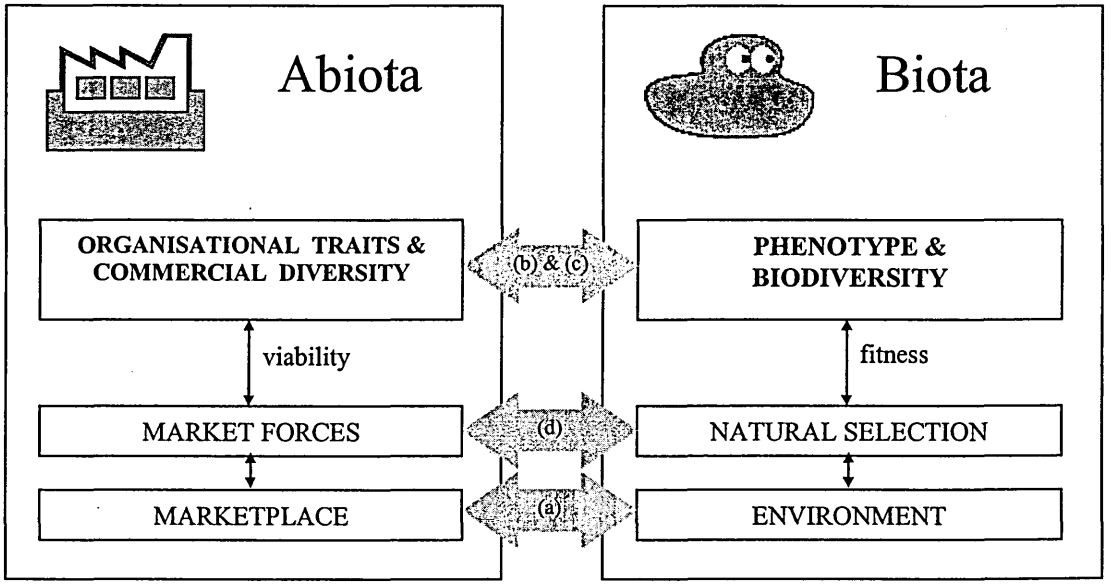

Figure 2-6: loosely analogous characteristics between biota and abiota

2.2.3 *A model of evolutionary biology*

In order to speculate that a biological model may lead to a better model of organisations the concepts and methods of biology need to be considered. Here much-simplified models of evolutionary biology and means of phylogenetic reconstruction will be overviewed.

2.2.3.1 Biological principles

The basic assumption is that of Darwinism; *reproduction, variation and natural selection* suggests a naturalistic explanation for the origin of the species (Darwin, 1858). Although the details of the actual process of biological evolution are fiercely debated (e.g. Dawkins, 1976; Midgley, 1979; Dawkins, 1981; Dennett, 1995; Gould; 1997) an idealised model is assumed here that has the constituent elements shown in figure 2-7. Each is discussed in turn.

2.2.3.1.1 Environment

Living system exist within and depend upon their surroundings which consist of climatic conditions, natural hazards & climate changes, food sources, competitors, predators, symbionts and parasites (Fig. 2-7 - a). There is a complexed interplay within such an ecosystem, which may at times be pacific but can also be subject to turbulent and unpredictable dynamics (Gleik, 1988; Waldrop, 1992; Kauffman, 1995). These factors mean that the environment has a finite carrying capacity that limits the level of sustainable population (as pointed out by Malthus, 1798).

2.2.3.1.2 Anatomical characters

A biote[13], being incarnate, has physical anatomical characteristics that constitute that specie's *phenotype*[14] (Fig. 2-7 - b) and determines the behavioural repertoire of the organism. A specie must have at least one differentiating *character* or *character state* from all others (Panchen, 1993) and the range of instantiated states constitutes biodiversity (Fig. 2-7 - c). The resemblance between characters has been used since Plato and Aristotle not only to distinguish between *species* but also to aggregate them into *genera,* which forms the basis for systematics - the science of classification.

2.2.3.1.3 Reproduction and Inheritance

It is long accepted that species reproduce (Fig. 2-7 - e) "according to their kind" (Gen, 1:22) in that offspring inherit their parent's phenotype and behavioural capacity. As reproductive ability is inherited (Fig. 2-7 - f) the concept of lineage is derived. A further implication is that multiple offspring can imply geometric increase in populations although this is curbed by the carrying capacity of the environment.

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[13] Taken also as applying to plants, fungi, prokaryotes etc.
[14] Gk *Phainomai* to appear (OED)

2.2.3.1.4 Natural Selection

The *fitness*[v] of an organism's phenotypical traits, in relation to environmental conditions, is instrumental to that organism's survival or expiry (Fig. 2-7 – d). Cuvier's comparative anatomy (circa 1800) between mastodons and modern elephants demonstrated that species extinction could occur (Osborne & Benton, 1996). Darwin (1858) suggested that characters that enhance survival chances are favourably inherited and thereby become more pervasive; over time and in lieu of limited resources, natural selection eliminates ill-fitting dysgenic species[15].

[15] It is noted that the existence of species systemically feeds back into the environment.

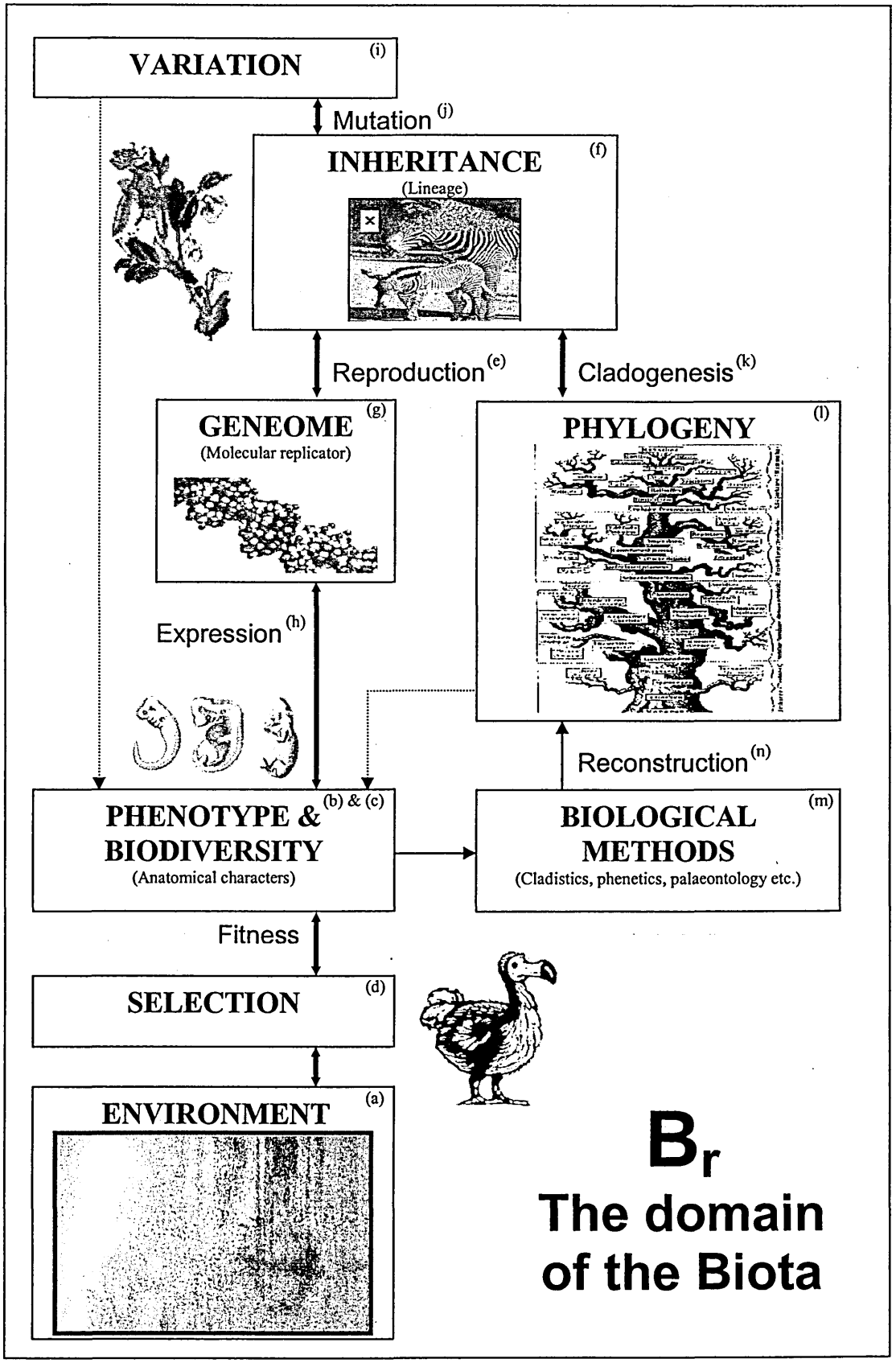

Figure 2-7. A model of components of biotic evolution

2.2.3.1.5 Variation

Although reproduction and selection are necessary for continuation of fit species, they are insufficient, as they do not allow new morphs to emerge. A third necessary condition is the transmutability of species through the introduction of variation (Fig. 2-7 - i) in phenotypical characters (Fig. 2-7 - b). Lamark suggested that organisms could acquire novel characters in accordance with environmental pressure; he also held the view of *orthogenesis* (that species had an innate tendency to evolve) and that changes made during an individuals lifetime are transmitted to its progeny. Darwin's theory, on the other hand has no component of orthogenesis. Although he had no idea about the process of variation (Cziko, 1995), the principle factor in an evolving population is in the production of individuals, through variation that are slightly better adapted to the environment and therefore more likely to be selected for. The steady accumulation results in modification of structure. In Darwinism, it is the interplay between *reproduction, variation and natural selection* that gives rise to *vicariance* - initiation of speciation (Fig. 2-7 - k).

2.2.3.1.6 Phylogeny

Tracing *intra-specific* lineage (particularly applied to human family trees) is the subject of genealogy. From the Darwinian premise that new species can arise (*phylogenesis*) through transmutation, there exists *inter-specific* lineages or pattern of evolutionary relationships (*descent*) between species (*Phylogeny* (Fig. 2-7 - l)). In terms of assumed specific evolutionary pattern, *anagenesis* is rejected in favour of *cladogenesis*. Anagenesis constitutes evolutionary change within a lineage with a continuum of inter-specific *morphs* (Fig. 2-8).

Figure 2-8. Anagenesis

Cladogenesis (Gk Clade *branch*), on the other hand (Fig. 2-9), posits vicariance though splitting of a lineage into two as characterised by the branching pattern of a tree called a *cladogram*.

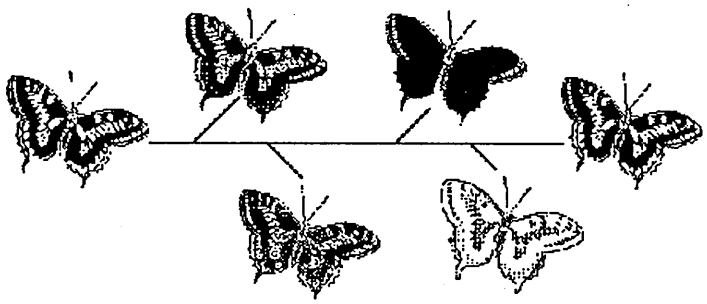

Figure 2-9. Cladogenesis

Another important assumption made here is that of *punctuated equilibrium* over *gradualism*. Gradualism, originating in the formulations of both Darwin and Wallace, says that evolutionary change is taking place on a regular and continuous basis with selection acting upon tiny adaptive differences. Eldredge & Gould (1972) alternatively suggested that punctuated equilibrium is the pattern of evolution whereby species exist in a stable state (equilibrium) for long periods that are periodically "punctuated" by sudden bursts of evolution. Or as quoted by Price (1995) Ager's Life of a Soldier - *Long periods of boredom interspersed with short moments of Terror.*

2.2.3.1.7 A molecular replicator

Assuming a naturalistic explanation for inheritance occurring through reproduction then there must be some hereditarily mechanism for the passing of anatomical characters. Mendel's experiments in plant hybridisation (1865) with *Pisum sativum* revealed that discrete 'factors' were inherited during reproduction and expressed (Fig. 2-7 - h) as physical traits as the plant developed thereby demonstrating that characteristics where codified in some way. Johannsen (who coined the term *gene*[16] for these fundamental units of inheritance) showed that through variation in characters arose due to *mutation* in the *genetic code* thereby driving evolution. Late 19th century microscopy had established the presence of *chromosomes* in the cells out of which bodies are composed and in 1903, both Sutton and Bovery, independently made the association between chromosomes and Mendel's factors (genes). From 1909 Morgan's research on the experimentally conducive fruit fly *Drosophila*

[16] also *geneotype* and *phenotype* where Johannsen's terms: the genotype (now called *genome*) is the set of genes that is *expressed*, though ontogeny and environmental factors manifests as the phenotype

melanogaster, further establishing the chemical basis for biological inheritance and mutation (Panchen, 1993). In 1953 Watson & Crick revealed the 'double-helix' structure of the DNA molecule, as the chemical *substrate* of the gene, DNA is capable of duplicating itself with near perfect fidelity while comparatively rare chemical copying errors account for genetic mutation (Fig. 2-7 - j) that drives evolution (Fig. 2-7 - g).

2.2.3.2 Systematics, Cladistics and Phenetics

The foregoing was a simplified set of assumptions about biology. A brief account will be presented of the scientific methods of classification that support the evolutionary biology's claim (Fig. 2-7 - m). It is noted that each taxonomic method does have its shortcomings, which is the reason why there are so many. Numerical taxonomy is later used in construction of the memetic methodology.

2.2.3.2.1 Classification

Classification is critical survival function that allows for the differentiation between safety and danger, between recognising what we might like and eat or what might like to eat us (Lakoff, 1987). As a philosophical exercise, the classification process has notable links with classical Greek thinkers and has become foundational to scientific knowledge. The process exposes relationships between entities[17] according to their characteristics thereby enabling hypotheses to be deduced and subsequently tested. While there are numerous approaches to classification (Reiners, 1998; van Overveld, 2000) monothetic clustering predominates[18] whereby essential characters define a grouping and are used to assist identification of what "kind" of thing something is.

Taxonomy is taken to mean *'the theoretical study of classification including its bases, principles, procedures and rules'* (Simpson, 1961 p11; McKelvey, 1978; Sneath & Sokal, 1973). In this way, taxonomy supplies concepts and definitions that offer understanding (and choice) of alternate methods and strategies of classification and a terminology by which the choice of assumptions may be communicated. Although taxonomy is at a methodologically higher level than classification, the terms are often

[17] and concepts

[18] I would suggest that differing clustering strategies constitute competing memetic alleles and that Aristotelian essentialism (especially in vulgar classification) has some fitness advantage probably owing to its comparative simplicity.

used synonymously (Sneath & Sokal, 1973). Both classification and taxonomy are at the same time processes and the products they generate[19].

A *taxon (*plural *taxa)* is a taxonomic element. Taxa can be *aggregated* by some defining characteristic (like a class) into a taxon of a higher *rank.* The definition is recursive, thereby forming an *aggregational, inclusive, hierarchy* of ranks (i.e. a tree). The lowest ranking taxa, the leafs, are without defined constituents.

Systematics attempts to understand diversity and origins of phenomena, their relationship with the environment, and to arrange them into a meaningful order (McKelvey, 1978). In particular systematics is concerned arranging zoological and botanical organisms into taxa, naming them and then attempting to account for these arrangements (Simpson, 1961; Sneath & Sokal, 1973). The mid-eighteenth century Swedish naturalist Carolus Linnaeus is seen as the father of *systematics* of natural history. Linnean systematics utilises physical traits and aggregates taxa by *general* similarities and differentiates by *specific* differences thereby providing the *binomial system* of nomenclature for classifying and identifying species; this is still in use today (Osborne and Benton, 1996; Freeman, 1972). The principle upshot of this is that naming is unique and identification of species is clear. Furthermore contingency rules for inclusion of newly discovered species, resolving name clashes and correcting taxonomic misclassification, exist within its methodology (Freeman, 1972), thereby avoiding the ambiguities inherent in vernacular naming. This system of taxonomy is set-theoretical and inclusively aggregates species into a hierarchy of ranks[20] according to commonality of anatomical features and forms the well-known structure.[vi]

Linneaus lived in a time when specific creation was unquestioned and therefore the origins of systematics are entirely based on resemblance and devoid of evolutionary inference. Before Darwin, the consensus opinion was that the systematic arrangements of biodiversity had and would continue be the way it was. Species' lineages were like vertical blinds spanning time from the creation to the eschaton.

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[19] A taxonomy for example is a result of the process of taxonomy.

[20] 'the traditional categories of rank, such as order, family, genus, may not be numerous enough even when expanded by intermediate ranks produced by prefixing the terms sub-, supet-, and infra-. Words such as "supersubfamily" would be ugly and prone to lead to confusion.' (Sneath & Sokal, 1973 p294)

Darwin however, said that species were not immutable and that the processes of reproduction with variation and natural selection resulted in gradual reshaping of organisms over extended periods of time. The implication became: because evolution causes minor transmutations then separate species may be related by their ancestry wherein approximate species will probably bear a resemblance. More importantly the implication is in both directions: *species that resemble each other are probably related by lineage*[21]. Consequently, it is reasonable to assume that a classification of the biota by similarities and differences might trace the patterns of descent through natural selection. The assumption that *systematics* can be used to establish *phylogeny* also casts an evolutionary light on the aggregational hierarchy whereby each branching suggests the introduction of variations in the tree of life stemming from some primordial organism.

2.2.3.2.2 Phylogenic Systematics or Cladistics

The concept of branching also explains why Hennig's (1966) '*phylogenic systematics*'[22] is otherwise known as *cladistics*. The fundamental assumption is that new species originate through *cladogenesis* - the branching of lineages (§2.2.3.1.6) - whereupon two sister species result. These differ in at least one character but are predominantly similar because of traits inherited from a common ancestor. Cladistics then, iteratively uses these shared derived character or *synapomorpies*[23] in order to identify groups with a common ancestor *(monophyly)* thereby attempting to reconstruct patterns of decent and expressing such in a *cladogram* (Patterson, 1982; Hickman et al 1974; Hennig, 1966).

2.2.3.2.3 Numerical Taxonomy or Phenetics

The assumptions that cladogenesis is brought about by minor variations in characters (mutations on a replicating genetic substrate §2.2.3.1.7) suggests that applying

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[21] situations such as convergent evolution whereby environmental conditions have shaped two separate lineages into very similar pheotypes (eg. The European wolf (*eutheria*) and Tazmanian wolf (*metatheria*) look fairly similar) cause anomalies in simplified interpretations of evolution.

[22] derived from linguistics

[23] Cladistic terminology is peculiar to itself and while a full treatment of cladistics is beyond the intention of this volume, a good glossary can be found on the Society of Australian Systematic Biologist website (http://www.science.uts.edu.au/sasb/Glossary.htm)

numerical methods may be used to reconstruct phylogeny[24]. Phenotype encoding upon apparent character states[25] enables phenetic distance or similarity to be measured (e.g. Hamming; Jaccard; Yule etc.) between species. Comparative distance measures suggest which species are most likely to of the more recent common. Applying cluster analysis techniques to phenetic distance measures as an indicator of phylogeny is called *numerical taxonomy* or *phenetics*[26] (Sneath & Sokal, 1973). Like cladistics, phenetics has terminology peculiar to itself although it operates on different principles and this has caused something of a methodological rift between evolutionists (Hull, 1988). Cladistics takes evolution as axiomatic in a concerted and deliberate attempt to reconstruct phylogeny from emerging characters. Phenetics, on the other hand makes its analysis upon all available characters without the *a priori* evolutionary assumption; any phylogenetic inference is made later. Sneath & Sokal have reviewed applications of factor and cluster analysis in the social sciences and have indirectly alluded to reconstruction of cultural phylogenesis.

2.2.3.2.4 Palaeontology and iteration

The fossil record, though incomplete, provides direct evidence of the history of life and offers another approach to the reconstruction of phylogeny. Various methods of dating may be used to assess the age of the fossil thereby conferring a chronological account of evolution. Phenetics and palaeontology work upon different data yet towards the same ends and therefore should yield similar results. While phenetics works on an ahistorical snapshot, palaeontology works on the time-line. These, along with other techniques (Such as molecular taxonomy), provide independent iterations of phylogenetic reconstruction (Fig. 2-7 - n).

[24] Shifts in characters can be modelled in terms of digital error (See appendix B)
[25] Phenotype and Phenetics refer to observable expressed traits; the terms are related to *phenomenon* as shown to the senses; and *phenol* which used to be used in lighting.
[26] The algorithms of cluster analysis will be discussed in due course

2.3 Hypothesising organisational "genes"

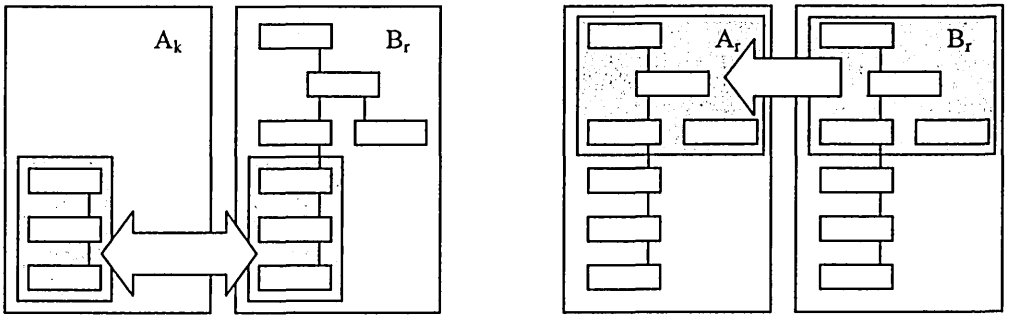
Based on certain analogues, the *abductive* method has suggested that the biology may provide a foundation for a naturalistic theory of organisations. So far, a certain degree of poetic licence has been reserved, but now it is time to apply reason and precipitate the metaphors into the semblance of a science: the *deductive* stage has been reached wherein the *isomorphic proposition* met earlier can be used to rationalise a series of organisational hypotheses that might be tested.

The research task is to check the possibility of a methodology for investigating, what has informally been termed, the organisational "gene" hypothesis. Although the organisational "gene" hypothesis is not the main concern, as the basis for developing and evaluating a memetic methodology, more precision is required and special attention is given to the organisational "gene".

2.3.1 Hypothesis rationale

i. One premise of positivism (and also of neo-positivism) is with the unification of natural & social sciences and from this it is possible to have a natural science of organisations.

ii. There are distinct analogues between abiotic organisations (A_k)[27] and a natural science model of biotic organisms (B_r) in terms of (a) dependency upon a surrounding environment, (b) characteristics, (c) diversity of form, and (d) viability with respect to selection forces. (Fig. 2-10 also §2.2.2)



Existing analogues (i.e. a to d) | New constituents (i.e. e onwards)

Figure 2-10. Translating constituents into the organisational model

iii. By the isomorphic proposition a good model can be translated from biology (Fig. 2-10) such that each constituent within the biological model (B_r) has a testable counterpart in the organisational model (A_r).

iv. Constituents of biological model that do not yet have a commonly recognised counterpart in the organisational model require are identified as (continuing the list): through (e) *reproduction* (f) *characters are inherited* via the mechanism of, (g) *replicating* molecular substrate (genome) and (h) *expressed.* (i) *Variation* through (j) *mutation* induces speciation through (k) *cladogenesis* thereby producing a (l) *phylogeny.*

v. Each missing constituent forms a hypothetical aspect of a more scientific organisational model. The isomorphic proposition may initially seem to present major disanalogies; the literature provides allusions or anecdotal evidence[28] as to how these disanalogies may be reconciled by equating concepts between domains. The potential meanings of the translated constituent may be as the following suggest[29] (Fig. 2-11):

(e) *Reproduction*: As Giddens & Pierson (1998 p77) note '*Society only has form, and that form only has effects on people, in so far as structure is produced and reproduced in what people do'.* An organisation can make copies of itself or, anthropocentrically, when one group of people copy the formative actions of another group, an organisation is copied. Franchising might be considered an *intra-specific* example. Organisational reproduction has its basis in rules' conveyance through processes of communication, learning (cf. Senge, 1990), training[30] conditioning (Skinner, 1971), apprenticeship, induction, indoctrination (Hassan, 1988; Singer, 1995), role modelling[31], team building, "norming" (Tuckman, 1965) by peer & social pressure, coercion (Schein, 1971; Cialdini,

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[27] Subscript notation is chosen to be consistent with previous models (§2.2.2)
[28] As the basis for future research
[29] only non-meme theory based references are made here
[30] A notable example where emphasis is placed on replicating the franchise is education at Hamburger University – (they don't make burgers out of ham either).
http://www.mcdonalds.com/corporate/careers/hambuniv/
[31] The term "duplication", is used by the Amway corporation (network marketing), to encourage distributors to model the exact behaviours and attitudes of their "up-lines".

1993) or authority (Milgram, 1974; French & Raven, 1959) *et cetera* from existing members of the organisation to new members or people outside the organisation. It may also take the form of benchmarking, industrial espionage or reverse engineering. *Iterated reproduction* would imply both *organisational lineage* and a *population dynamic* (Aldrich, 1999). We might call organisational "reproduction", following Amway terminology, *duplication*[vii].

(f) *Character inheritance*: By the process of duplicating form, the new organisation will bear a close resemblance to its parent(s[32]). In the previous example, traits such as: products, promotions, standards, reporting structures, corporate image etc. are preserved through inheritance or *imitation* within each franchise.

(g) *Replicating substrate*: The organisation itself is not copied but rather an underlying *business blueprint*; the information pattern for building another copy of the organisation is replicated. The substrate may be composed of power structures, policies & prohibitions, strategies & plans, rules & regulations, standard operating procedures, skills, knowledge, trade secrets or various informal traditions, cultures or unwritten rules (Scott-Morgan, 1994). This blueprint would be the mechanism of organisational "inheritance" and is congruent with the idea of the meme (discussed in more detail later).

(h) *Expression*: The underlying substrate is expressed as the organisational phenotype where the business blueprint is *actualised* (or literally incorporated) as activity, services, products, buildings, logos & trademarks, structures or other observable traits.

(i) *Variation*: While inheritance ensures the organisational descendent may bear a phenotypical likeness to its parent, variation would entail that the resemblance is inexact and that certain characters might be different. Such a variant would constitute a new organisational form. Variation may be imposed though such legislative acts as patents, copy-write and other means of protecting intellectual property. On the other hand, internal variation may be proscribed by corporate regulation. Market viability then selects which novel features rise to the "stars" or go to the "dogs" (Boston Consulting Group, 1970[viii])

(j) *Mutation*: Organisational variation is generally claimed, particularly by management, to be the result of deliberate rational foresight and planning (Porter,

[32] the means of reproduction are not considered here. It is possible that exotic processes exist that have not been exploited in biological design space.

1980). At the other extreme, the efforts of management can be seen as epiphenomena whereby blind variation is introduced through happenchance (cf. Whittington, 1993). *Innovations* are occurring upon the ideological substrate of the business blueprint via mechanisms of: miscommunication, misunderstandings, duplication error, transpositions & re-combinations of existing ideas, learning of new concepts, or the reinterpretations of old ones from alternative frames of reference. (Koestler, 1964; DeBono, 1971, 1985, 1992; Buzan, 1991; Gardner, 1983; Dilts, Epstein & Dilts, 1991).

(k) *Speciation through cladogenesis*: Introduced variations means that a new organisational form would coincide with the branching (*cladogenesis*) of an organisational lineage. These separating lineages represent organisational species whereby each specie is identified by its phenotypical characteristics (McKelvey, 1975, 1978; McCarthey et. al. 1997; McCarthey, 1998).

(l) *Phylogeny*: Iterated splitting events of organisational lineages result in an organisational phylogeny whereby different branches relate to businesses or institutions with a wide range of characters, operating in different marketplaces.

vi. Although the apparent disanalogies (Marsden, 1998b reviewing Price & Shaw, 1998) between organisms and organisations can be accommodated by theories present in existing non-memetic literature, the meme concept provides an efficient way of consolidating the model. The meme not only supplies a credible analogue for the gene (as organisational blueprint in point (g)), but also furnishes a consistent theoretical[33] basis for the other constituents: (a) Giddens, who suggests that social structure is reproduced but couldn't see how evolution could help sociology (debate with Runciman Appendix N), has yet to argue against a non-genetic replicator; (b) the meme offers a mechanism of character inheritance as (h) expression as organisations traits: routines & competences etc.; i) organisational variation and creativity are introduced through (j) mutations or erroneous copying of the meme (k & l) leading to organisational schism (speciation) and therefore phylogenies. Because the meme balances the biotic an abiotic domains so conveniently then it could be considered to be equivalent to an *organisational "gene"*.

[33] A meme theoretical approach to each of the model's elements has been reviewed in part 1.

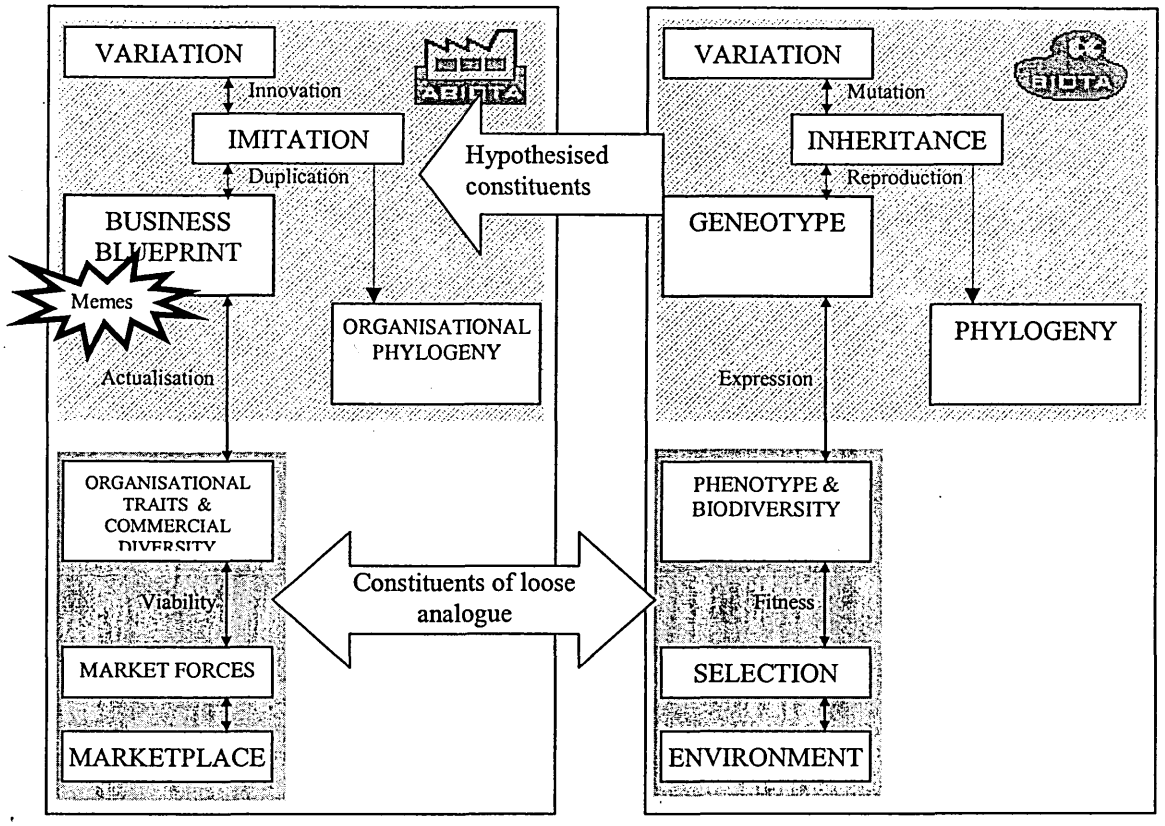

Figure 2-11. Biotic inference of characters in the abiota

2.3.2 The organisational "gene" hypothesis explained

The organisational "gene" uses imprecise imagery intentionally yet it conveys the gist of the research in one snappy phrase. On approaching the development of a prototype methodology (based on that hypothesis), then emotive phrasing needs replacing by formality and accuracy:

> **In certain types of existing abiotic societal entities there is some substrate that enables information replication that, through the development of a new entity, may be expressed as inherited characteristics.**

Each part will be examined in turn:

i. **In certain types of existing abiotic societal entities**: *abiotic* (§1.1.5). *societal entities* is intended to convey a most general class of social construct that might be conceptually clustered centrally around what are commonly referred to as *organisations* (§2.2.2). Determining the extent to which the hypothesis applies is for future research. Here however, it is thought to apply at least to the pilot group.

ii. **there is some substrate that enables information replication**: Although it is unnecessary to define the mediate substrate itself, its existence is necessary in order to enable information[34] storage, iterated transmission and replication (Gabora, 1997). Such replicating information may be considered synonymous with *memotype.*

iii. **that, through the development of a new entity may be expressed as inherited characteristics. :** During formation of an organisation (of the certain type) its characteristics are implementations of the blueprint that has been replicated by an existing organisation (expressed memes).

The organisational "gene" hypothesis is potentially as controversial to management science as the selfish-gene is to biology and is starting to attract the attention of management theorists (as reviewed in part 1: Price & Shaw, 1998; Aldrich, 1999). Rather than exploring the theoretical implications, this research now takes the hypothesis so as to propose a methodology for balancing the remaining constituents of the isomorphic proposition: biological methods.

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[34] Information: To give structure; to give vital organising power. Webster's Revised Unabridged Dictionary. It is the researchers view that information is the principal of organisation

2.4 Methodology development

The organisational "gene" hypothesis offers to bridge the gap between natural and social sciences. Given this hypothesis is worth perusing (at some point), the objective becomes to find positive evidence of a mechanism of organisational inheritance. Should there exists a discernable pattern consistent with traits being hereditary then there would be a case for asserting the existence of an inheritance mechanism (i.e. the meme); other constituents of the isomorphic proposition would also be supported (§2.3.1). Hence the issue can be rephrased:

- How can we discern a pattern that is consistent with hereditary traits in organisations? (as per organisational "gene" hypothesis previously in §2.3.2)
- Where can such patterns be found?
- What do they look like?

In part 1, it was argued that under present constraints, research objectives should be modest. Clearly the above issue is overly ambitious (especially in proving the universal case) so the study requires strictly limiting to what can reasonably be achieved. Moreover, as organisational memetics is a fledgling concept and, as no methods have been sufficiently established, then research is confined to performing the groundwork of methodological feasibility. In a similar deduction of the *organisational "gene" hypothesis* (§2.3), it is possible to reason out a *methodological hypothesis: that memetic methods are possible*[35]. As previously alluded, it will be proposed that biological methods might be applied to this task.

This methodological hypothesis raises a third and central issue: if we can find, translate or develop a method that works, even though the genealisability and accuracy may remain unknown, then that would be *sufficient to demonstrate that memetic methods are at least possible* (this is what the research sets out to answer). How do we know a method works? The obvious answer would be to try it out[36], but against what? It cannot be gauged against known patterns of inheritance because, paradoxically, there has been no validated method for establishing those patterns; perhaps this is why a science of memetics has been inhibited. The real contribution of

[35] for showing the presence of a mechanism of trait inheritance among organisations
[36] which is done in part 3

the present research might be regarded as its methodological bootstrapping in breaking the impasse.

This remainder of this section will adduce that the feasibility (of a memetic technique) can be judged relative, according to prescribed criteria, to a second independent, "non-memetic" iteration. The overall approach is discussed here, while a breakdown into operational research activities is detailed later (in §2.5); part 3 applies the method to a pilot case.

2.4.1 Methodological isomorphism

The isomorphic proposition has so far had a balancing effect between a set of constituents of the biotic and abiotic models and in particular has given rise to the organisational "gene" hypothesis. The preservation of isomorphism, from its mathematical origins (§2.2.1.2 & 2.2.1.3), also requires an equivalence of *operations* between domains; biological methods of investigation should translate to some hypothetical organisational equivalent. A case for *methodological isomorphism* can be made which suggests that phenetics is a strong candidate for a memetic method.

2.4.1.1 In biology, phenotype & diversity have been the basis for systematics

The mechanisms of biological evolution (2.2.3) have produced patterns of descent and immense biodiversity that have been reconstructed through systematic methodologies such as iterations between cladistics, phenetics, molecular genetics, palaeontology and so fourth (Fig. 2-7 – m). These rigorous scientific approaches have given the naturalistic phylogenetic explanation for biodiversity credence over supernatural accounts of special creation. Methods of phylogenic reconstruction then reveal evolutionary patterns of *reproduction, variation* and *natural selection* – mediated by the biological mechanism of inheritance: the genome.

2.4.1.2 Commercial diversity & traits have biological analogues

In the isomorphism, biodiversity is seen as analogous to commercial diversity (*abiodiversity*) that is evident from the array of existing organisations and their traits. Furthermore, vernacular typologies have traditionally agglomerated organisations into divergent hierarchies of classes such as government, commercial, charities, associations, cartels, activist or political, criminal, religious and so on. A conventional

explanation for organisational morphology would be akin to the view held in Linnaean times where phenetic relationships existed without phylitic ones. The isomorphic proposition, on the other hand, would contend a phylogenic hypothesis: *the divergent agglomerative structure of commercial diversity (based on their apparent traits) results from a pattern of descent with modification.*

2.4.1.3 Biota to abiota method translation & existing theoretical arguments

Presuming organisational phylogenesis for a moment, then to some extent, it should be possible to trace patterns of descent from organisational traits. A trait-based method of reconstructing organisational phylogeny is required; fortunately biological methods of phylogenic reconstruction have been extensively tested. Preserving methodological isomorphism might be achieved through analogues of cladistics, phenetics, molecular genetics, palaeontology, and so on (Fig. 2-12). Trait based phylogenic reconstruction would also be consistent with the presence of an organisational replicator; the mechanism of descent with modification.

Notably Dennett (1995 p357) has pointed to '*the imagined field of cultural cladistics*' (see §1.2.1.3) though complains that '*lines of descent are hopelessly muddled*' entailing that '*a science that charts that descent are slim*' (*ibid*, p356). Wilkins (1998) on the other hand, is more optimistic[37] [38]

> The methodological future of memetics lies in the use of techniques drawn from information theory, modern taxonomy and computer science. By interpreting memes as messages, we can make use of Shannon-Weaver entropy [and] cladistics ...
>
> The problem of classification lies at two ends of the scale - identifying cultural traditions as they exist now and over time, and identifying elements of those traditions as they persist and recombine. Although this sounds subjective, it need not be. Behavioural regularities indicate that something objective has been spread, and even if the underlying memes cannot be formulated in some universal logical language, the structure of memes can still be identified in the same way as Mendelian genes and molecular sequences, through the use of consensus maps and by noting when their absence or presence makes a difference.
>
> The analytic tools available to us are legion, having been developed in biology over a century or more. They include Wagner groundplan methods (unrooted character similarity trees based on presence-absence matrices), Hamming Distance measures (the sum of the number of simple differences between two memes), cladistic reconstruction using parsimony methods, and pattern recognition methods that use neural networks and

[37] Indeed the methods employed in this research relates to what Wilkins has noted on modern computational taxonomy (Appendix C) using Shannon's and Hamming's ideas (Appendix B).
[38] Until recently I was for some reason, unaware of this part of the Wilkins paper. Although my research methods had been developed independently by this time (1998).

> other connectionist models. Eventually, these and other methods will no doubt be incorporated into a body of canonical techniques within the memetic enterprise, and I expect they will be generalized as methods applicable in a range of social disciplines.

In terms of practical application and following McKelvey (1978), cladistic methods have been applied to manufacturing and drug discovery (McCarthy et. al., 1997; McCarthey, 1998; Tsinopoulos & McCarthy, 2002; Fernandez & McCarthy, 2002).

2.4.1.4 Methodological difficulties for cladistics

The application of cladistics requires the *a priori* assumption of phylogeny (see §1.2.2). For biology, cladistics is made applicable by the modern synthesis between Darwin and Mendel. The organisational application therefore is faced with a certain methodological difficulty: *phylogeny is not a premise but rather a hypothesis*[39] *that remains to be tested.* The danger in not challenging the assumption is that, in reapplying biological methods it is possible to construct phantom patterns of organisational descent. Cladistics (and other approaches to evolutionary parsimony) may become powerful as memetic tools if it could be known that traits, in a given organisational study, were inherited. Hence, establishing organisational phylogenesis is a prerequisite for any attempt in determining the exact pattern of descent.

2.4.1.5 The methodological hypothesis and phenetics

Methodological isomorphism suggests that divergent agglomerative structure of commercial diversity may result from a pattern of descent with modification. A further component of the isomorphic proposition isomorphism is a *methodological hypothesis,* that there is a feasible method for indicating the presence of a mechanism of trait inheritance among at least one group of organisations. Although cladistics suffers from methodological difficulties, there are other trait-based methods, such as phenetics, which do not carry the *a priori* assumption of phylogeny. Indeed, as Sneath and Sokal (1973, p9) point out there is *'... a strict separation of phylogenetic speculation from taxonomic procedure ... these phenetic relationships do not take into account the origin of the resemblance found.'*

[39] As generated through the isomorphic proposition. see §2.3.1 – property (l)

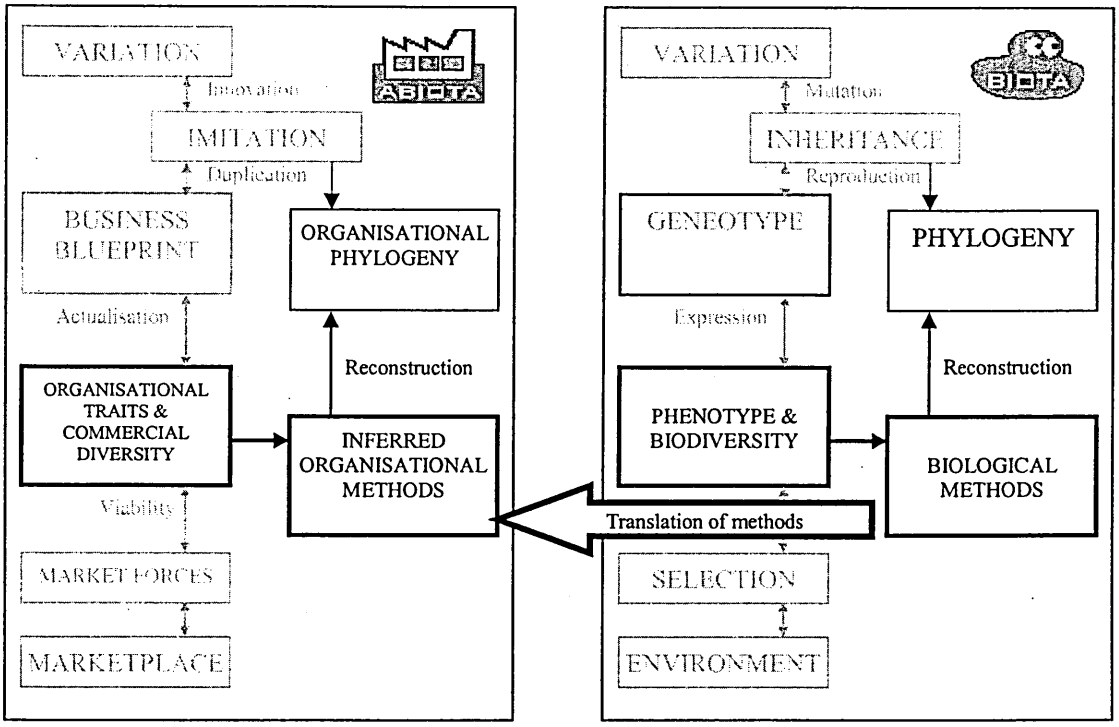

Figure 2-12. Biotic inference of characters in the abiota

2.4.2 *Evaluating the methodological hypothesis*

The situation is thus: Commercial diversity and traits can be classed within a divergent agglomerative structure; organisational phylogeny offers a plausible explanation, which would implicate a mechanism of trait inheritance. We know neither that a pattern of descent exists nor do we currently have a means of showing that such a pattern may exist. It is not even known whether such a means is viable, which this research aims to address.

2.4.2.1 Iterations between methods

In isolation, methods of phylogeny reconstruction in biology face similar problems of validity. Although natural selection may be continuous, geological timescales have prevented humans from directly witnessing the occurrence of evolution. Lack of immediate observation has fuelled the creationist argument. Direct observation may not be possible but then neither is it necessary. Biological methods are not used in isolation but rather as independent iterations using differing methods; should these iterations corroborate then a picture of natural history can be built up. Particularly useful are the links between palaeontology's account from fragmentary fossil records

and phylogenetic explanations of extent species. This idea of independent iterations may be translate to the organisational domain.

A prototype to show inherited organisational traits may involve analogues of: cladistics, phenetics, molecular genetics, palaeontology. Cladistics has been ruled out because it inherently assumes that which is to be tested for. Molecular genetics may be the equivalent to semiotic or linguistic analysis, such as lexical phenomenography (Lissack, *s.d.*), which might become useful as the field of memetics progresses.

Phenetics, on the other hand, offers a very general technique for clustering according to traits; it doesn't take phylogeny *a priori*, nor does it attempt to show phylogeny directly. However, given the additional premise of trait inheritance then phylitic relationships might be inferred.

Palaeontology's reconstruction from fossil records may equate to historical methods based on archaeological or archive information; genealogy may be regarded as a special case whereby archival evidence is used to build ancestral family trees. In contrast to biology, organisations are the products of human endeavour and therefore most have existed within recorded history. Certain organisational groupings have extensive and reliable historical archives[40] wherein, at least in part, an organisational "family tree" is immediately discernable; consequently the issue of the assumption of descent can be resolved reliably.

2.4.2.2 Diachronic / Synchronic convergence

Phenomena may be analysed from either a chronological perspective that examines dynamics (on the diachronic axis); or from the snapshot perspective of structuralism (on the synchronic axis). Although diachronic and synchronic analyses may be independent, naturalism posits a relationship between them (Fig. 1-2). Where there is phylogenesis then patterns of trait inheritance, through the mechanisms of descent with modification, are likely to be reflected in a trait-based classification because similar appearances stem from similar origins.

[40] This is one criterion for test group selection of the pilot study.

Consequently, structure, distribution, and diversity of the biota, as they stand today (synchronic), should reflect evolutionary history and the origin of the species as partially corroborated by the fossil record (diachronic). The relationship between the two axes is provided by the inheritance mechanism of the gene.

The hypothesis of organisational phylogenesis would suggest, similar to the biological case, that trait inheritance patterns by descent (diachronic) are reflected in a trait-based classification (synchronic). Stated another way: where descent reflects classification then a likely explanation is that traits are hereditary, which supports the organisational "gene" hypothesis.

2.4.2.3 Insufficiency of phenetics alone and methodological criteria

Returning to the *methodological hypothesis* (§2.4) that a method can be found which indicates the presence of a trait inheritance mechanism among organisations. The difficulty is in knowing whether the method works or not.

Although phenetic cluster analysis does not suffer the *a priori* assumptions of cladistics, phenetics alone is insufficient. Firstly, as an abstract algorithm, it may be just about applied to any common set of characteristics from any group of objects irrespective of origin; doing so does not necessarily yield any useful information other than mapping apparent similarity. Secondly, although it is safe to say that clustering might *possibly* reflect evolutionary decent, saying that it *necessarily* does, reintroduces the problems faced by cladistics: a risk of producing phantom phylogenies.

Certainty needs adding to the possibility provided by phenetics; fortunately, the iteration between synchronic and diachronic analysis provides a resolution. On the one hand organisational history can be reconstructed directly from the records; on the other hand, phenetic clustering can be performed upon organisational traits. The historical iteration reconstructs phylogeny without regard to traits, while phenetics clusters traits without regard for historical information – they are independent from each other. Where the two reconstructed patterns do concur then it is arguable that the pattern of traits arises *as a result of* the pattern of descent through inheritance.

Consequently the methodological hypothesis is dependent upon the following criteria:

1. *A method of reconstructing an accurate pattern of descent directly from historical evidence along the diachronic axis, without regard to traits.* This criterion is met by "phylogenealogy": a version of genealogy (§2.4.3.1) modified to reconstruct *monopylitic* groups. The result is depicted as a tree known as a phylogram.
2. *A method of clustering a pattern of resemblance between traits along the synchronic axis, without regard to historical information.* Phenetics (numerical taxonomy), common in biology, is abstract enough an algorithm to be translated to the organisational domain. It should be noted that this criterion could be met providing there are a common set of traits irrelevant of the first criterion. The difficulty is that there are many options to choose from across many parameters (§2.4.3.2). The result is depicted as a tree known as a phenogram.
3. *The two methods are mutually independent.* The synchronic and diachronic axes are mutually orthogonal: phenetics is based entirely on trait data; phylogenealogy entirely on ancestry.
4. *The pattern of trait resemblance sufficiently matches the pattern of actual descent.* As the first three criteria are assured by the methodology (and pilot selection §2.4.2.5) then this fourth criterion is what provides the test. The two resultant trees: phylogram and phenogram can be compared. Unfortunately this is the greatest area of subjectivity on the grounds that there is no known[41] metric of similarity between the two patterns (§2.4.3.3). It is assumed that there is a subjective threshold whereby there appears to be a match.

Notably there are many systems, algorithms and readily available software that attempt to tries to reconstruct phylogeny based on character information, under the assumption that characters are inherited. (cf. DNA sequencing, Wagner Ground plan, or other parsimony methods). While it may be tempting to use these to meet the second and fourth criterion, because like cladistics, they assume *a priori* that characters are inherited, then they violate criterion 3 and must be rejected. Consequently, neutral clustering meets criterion 3, while any inference of an inheritance-based match should be made *a postiori*.

[41] The research has not been able to find one.

2.4.2.4 Outcome matrix

The first two criteria can be selected for, while the third is inherent. Assuming due diligence in applying research techniques then the actual test for success is gauged on the fourth criterion. It is supposed that: where the synchronic-diachronic iterations match[42], then traits are inherited; where there is mismatch then they traits are not[43].

There are two dimensions: (a) iterations mismatch or match; (b) inheritance is absent or present (Table 2-1). The question is how can the supposed correlation be claimed when (paradoxically) there is no established way of determining inheritance directly? Introducing a third method of reconstruction would defeat the object of the research. The answer is to systematically eliminate the inverse correlation. The quadrants are dealt with as follows:

2.4.2.4.1 Inheritance is present

In the presence of inheritance mechanisms then methodological error might result in mismatch. A particular problem is with error multiplication wherein inaccuracies are introduced at various stages and is most likely to manifest as a *mismatch-present* condition. By simulating a pattern of descent with inheritance then a resultant set of traits can be generated; reconstructions from the traits can be tested against the known pattern of descent. In this way, simulation circumvents the paradox. Extensive testing of the method using software[44], while reducing the *mismatch-present* problem, supports the *match-present* case.

There is however a problem where lineages are, as Dennett (1995, p357) puts it, '*hopelessly muddled*'; or where replicator fidelity is so low that offspring would have limited resemblance to their ancestors. Presumably, there might be many cases of rapid evolution that would be unamenable to the methodology suggested herein. Again the research aim, at this juncture, is to test for the possibility of method; such cases should be set aside while empirical memetics sophisticates.

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[42] Subject to methodological limitations

[43] As will be shown in light of the pilot, the principle holds although the processes and reasons turn out to be a little more involved.

[44] The role of EDEN-ML (Appendix C) was to facilitate extensive testing of the method by simulating memetic evolution.

2.4.2.4.2 Inheritance is absent

Is still possible to produce a match in the absence of inheritance, even assuming testing has supported the method. Taking a phylitic inference of phenetic analysis where there is no inheritance might produce a phantom that coincidentally matches descent. The combinatorial probabilities of producing a false positive match for randomised character states rapidly tend to zero the more characters are introduced. The methodological difficulty stems from the researcher selection and de-selection of taxa, characters, and character states; even with the aim of impartial objectivity, unconscious motives may bias selection producing an unwarranted match. Within the confines of the present study such a bias neither easy to detect nor eliminate. A solution can be envisaged however: firstly, to determine the probability of coincidental match (or degrees thereof); and secondly, to distribute various research tasks (algorithm selection, taxa selection, character data capture, and processing etc.) among independent and unprejudiced parties. By taking steps to reduce bias then it would be better known how significant a match was for showing inheritance or a mismatch was for dismissing it.

2.4.2.4.3 Correlation

The inverse correlation, subject to research constraints, is either unlikely, or due to methodological errors, or screened out. Eliminating these two quadrants from table 2-1 leaves a correlation between matching and inheritance. The match between actual and phenetically inferred descent can now be tested against pilot data to see whether the method is feasible.

Outcome matrix		Comparison between patterns of descent and trait resemblance	
		Mismatch	Match
Inheritance mechanism	Absent	Hypothesis unsupported	Likelihood of producing correct tree from coincidental characters is (combinatorial) very low.
	Present	Methodological hypothesis invalid or logical error in method – only testable through simulation	Hypothesis supported

Table 2-1. Outcome matrix of possible test results

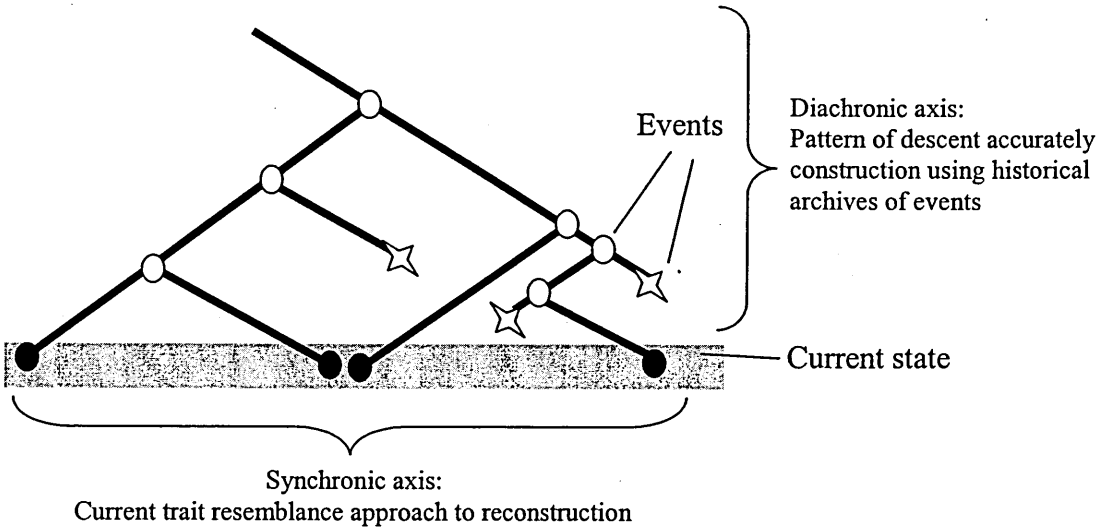

Figure 2-13. Relationship between phenetic and genealogical iterations

2.4.2.5 Using a pilot study

In addition to the above criteria, there is the additional need for a pilot study. The iterations are well known in their biological context; their translation to the organisational domain is un-established. Insofar as the methodological hypothesis goes, *it is necessary to perform a pilot study* otherwise the method will remain an untested abstraction. This research concerns method rather than any particular type of organisation. In order to perform the test, it is necessary to have historical and trait data available (to conform to criteria 1 & 2). Further, as the phenetic construction will always produce a rooted dendrogram then, to validate the test (criterion 4), then the pilot should be a "monophyletic" group (criteria for pilot selection are made explicit in §3.2.1).

2.4.2.5.1 Validating the test: Testing for vs. Testing against

Ideally, two test cases would be required (although repeating in other organisational sectors may reinforce the claim)

+ A positive case match-present case between phylogram and phenogram
− A negative case mismatch-absent case between phylogram and phenogram

Once more, the problem is the paradox of methodological bootstrapping: we can't validate the method against proven benchmarks where inheritance exists or not, as this is what the method is trying to demonstrate. Even where there is a strong hunch (i.e. Western Christian Schism used in part 3) this *method is testing for hypothesised inheritance*, and not testing against known inheritance; however we might anticipate a

positive result. On the other hand, attempting to a real case where phylogeny is known and where characters are though *not* to be inherited is even more difficult. For this reason, simulations on virtual "meme-strips" was conducted.

2.4.2.5.2 Possible scenarios

In considering a real world pilot, a few scenarios need to be considered:

A. *What if there what if there is no descent between any organisations?* That is, they were only related by resemblances. In this case, the present methodology would be groundless, as the first criterion could never be met: the possibility of a memetic methodology would have been falsified. Absence of descent would be difficult to show however, and research would be then tasked to explain spontaneous organisational formation. This case can be ruled out though, as descent has been positively asserted among the group used in the pilot (part 3).

B. *A negative case choosing deliberately unrelated*[45] *organisations.* Although such a case would defeat the objective by failing the first criterion, it is at least worthy of thought experiment even if actually conducting it has little value. Reconstructing a direct picture of descent where there is none would be erroneous. Phenetic analysis could still be performed in any case but, having asserted the absence of descent, offers resemblance without phylogenic interpretation; it would be concluded that any similarity between organisations arise though some non-inherited route such as directly from the environment, or are coincidental (again a measure of significance might be helpful).

C. *Descent is known to exist but the pattern cannot be reconstructed directly.* Where *descent is assumed* then cladistics (or other potential methods drawn from biology) may be better suited to reconstruction.

D. *It is uncertain whether descent is present or not.* Again, reconstruction methods may be better although a falsely assuming of descent might produce a phantom. The value of reconstruction methods in these cases is providing a clue to a more detailed historical investigation.

E. *Descent is known to exist and can be reconstructed directly.*
   1. This known pattern of descent meets with criterion 1 (the previous scenarios do not);
   2. phenetics can be applied to any common set of characters (criterion 2);

[45] It is not known whether there are organisations unrelated by descent or whether they all share a common ancestor.

3. the methods by definition, are mutually independent (criterion 3);
4. then the issue is the test criterion (4) of producing either a match or mismatch (according to the assumed subjective threshold[46]).

2.4.2.5.3 Possible results of a pilot and inferences

This final scenario of using a clearly established phylogeny, providing it is "monophyletic" can be used as the pilot. Although errors, bugs, insufficient testing, researcher's scotoma or other undetected problems cannot be ruled out, the following outcomes are considered:

\+ Where there is a match, then the most likely explanation is organisational phylogenesis: the pattern of traits has accompanied the pattern of descent.

− Where phylogeny is known to be present (criterion 1) yet a clear and significant mismatch occurs, then the most likely of the many explanations are:

- there is no mechanism of trait inheritance;
- or that fidelity isn't sufficient to sustain resemblances between generations;
- or by convergent/parallel evolution may be taking place.

? A third possibility is where a match is un-decidable; no meaningful inferences could be made.

It is anticipated then, that a pilot case (where there is a strong suggestion of inheritance ie Western Christianity) that meets the four criteria[47] and is not disconfirmed in a specific case, suggests the possibility that a method may be found which indicates the presence of a trait inheritance mechanism among organisations. On the other hand, the present research method may have failed to demonstrate inheritance, or at best would need refining. Such a failure however should not be taken conclusively that memetic methodologies are unfeasible and that the whole branch of inquiry should be abandoned, but rather that the present attempt was unfruitful; other researchers in the future might try alternative routes.

[46] If the result is un-decidable then another pilot case should be taken.
[47] Further criteria for pilot selection along with actual application, will be met in part 4.

2.4.2.6 Limitations and weaknesses of methodology

Assuming the inability to access and process data or poor choice of pilot sample, there are some intrinsic methodological difficulties, which impose limits when considering the methods use outside of this study.

In terms of direct construction along the diachronic axis ("phylogenealogy"), the method demands that, for other than the root node, each taxon must have one and only one identifiable parent; the reason for this imposition is that it facilitates comparison with the trait based iteration. This may be the case for organisational forms such as the pilot (western Christian denominations), but notions such as best practice and benchmarking, make the process unsuitable for many sectors.

The criterion of making the analytical axes mutually independent, thereby employing phenetics, entails that the method inherits the problems of phenetics; the weaknesses in its biological application also translate over the isomorphic proposition! Issues arise over estimating phenetic relationships (Sneath & Sokal, 1973):

1. Incongruence between classifications can be brought about by mismatching characters between taxa (dealt with in §2.5.4.1.1)
2. Differences in estimate of relationships produced by different similarity coefficients (dealt with in §2.4.3.2 & §2.5.4.2.1)
3. Differences in interpreting relationships produced by different clustering methods (dealt with in §2.4.3.2 & §2.5.4.2.3)
4. Possible effects of parallelism and convergence (and hybridisation are considered with the pilot case.)

These issues will be addressed in their relevant sections; while they are important to phenetic methods, their accuracy and relevance to the present methodological evaluation is lessened. The problem with inaccuracy is that it can creep in at any stage thereby multiplying errors and are likely to result in the *mismatch-present* condition (considered in §2.4.2.4.1).

By far the biggest difficulty is with making the final comparison between the iterations, as, although both may be depicted as treelike structures, they don't represent the same information. The phenogram only clusters by appearances; it does not depict ancestry as that would become cladistic. As no established metric of similarity between the analyses has been found then their matching requires the

subjective appraisal: ancestral clusters should hold a much better than random correspondence to clusters formed from traits.

2.4.3 Translation between domains

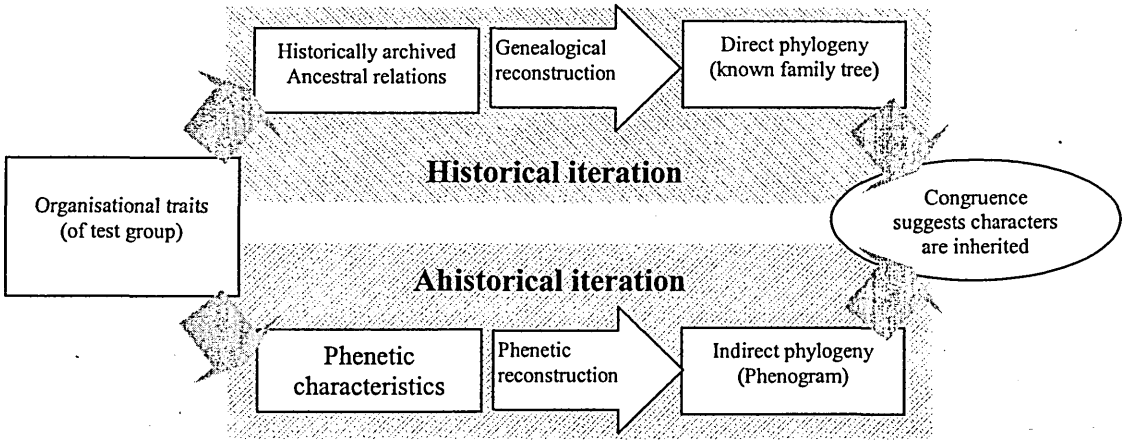

Figure 2-14. Two independent strands of phylogeny reconstruction should produce similar results

The forgoing indicates that both direct historical and indirect ahistorical iterations are required. Congruency between reconstructions would be consistent with a mechanism by which traits are inherited thereby supporting the memetic hypothesis. Here, it is suggested that genealogical and phenetic methods allow appropriate translations (Fig. 2-14), and the nature of, and relationship between these iterations are covered; specific details are left until later (§2.5).

2.4.3.1 Direct reconstruction of phylogeny using genealogical methods

The first iteration along the diachronic axis establishes the presence of organisational phylogeny and actual pattern of descent directly. The objective here is to provide a known phylogeny (using only ancestry without reference to traits) by which to validate the trait-based iteration. Genealogical methods (related to palaeontology) use direct historical data and are presented for translation.

2.4.3.1.1 Genealogical method

Genealogy is the method of determining ones ancestry descent directly from historical documentation and involves ascertaining who are the parents of whom by investigating parish records, registers of births, deaths & marriages, gravestones, news

articles and so on[48]. As the parental relationship is recursive then this information can be reconstructed into a family (genealogical) tree thereby allowing lineages to be established and represented graphically. Because of the predominant application of tracing human ancestry, genealogy considers two parents (sexual reproduction). Similar methods could however be adapted to trace ancestry in species with asexual or vegetative reproduction by knowing the single parent.

2.4.3.1.2 Relationship between genealogy and phylogeny & palaeontology

Genealogy and phylogeny are special cases of each other in that both trace ancestral lineages. The subject of genealogy is intra-specific and within a timescale that has not enabled evolution to produce characteristic differences among individuals in the study. For this reason genealogy has to be based on historical assertions of ancestry.

Phylogeny, on the other hand, is the inter-specific[49] study of ancestral relationships that have arisen through differences caused by evolution over extended timescales. Palaeontology, as a contributory iteration of phylogenic reconstruction based on the fossil records, is methodologically related to, and maybe considered as an extension of genealogy. Here, applying genealogy inter-specifically, under the assumption that there is single ancestor specie, produces a phylogeny (depicted by a single rooted divergent *phylogram*); this adaptation might be termed *mono-phylogenealogy*.

2.4.3.1.3 Organisational phylogenealogy

The main consideration is that organisations are products of human activity, which means that most of them have existed within the Holocene timescale of recorded history. Organisational speciation then is also within historical times and in many cases the events leading to the creation of a new form have been archived. This historical information allows for the genealogical approach to and the direct reconstruction of phylogeny. This requires some method of establishing what constitutes the emergence of a new organisation and how its "parent" can be found. It is suggested that the concept of "organisational speciation" seems intuitively known to archivists and explicit statements suggest evidence for such (method detailed in section §2.5.3).

[48] Literature concentrates on specific methods, but omits to make explicit "obvious" methodological assumptions (such as descent, the requirement of two parents etc.)

[49] Between species as opposed to individuals

The method of phylogenealogy is very general and can be applied to any diverging organisational form providing it is possible to establish the single ancestor for each (but one: the root) organisation in a sample. Looking outside the present research, then the assumption is that there may be many and varied ways that organisations come about, in which case the phylogenealogical method may be inappropriate or require modification.

2.4.3.2 Indirect reconstruction of phylogeny using phenetics

Given that a reliable organisational phylogeny may be directly reconstructed from historical data without using other characters. Then a second independent iteration is to indirectly reconstruct phylogeny from organisational traits without using historical data. Phenetics offers a starting point.

2.4.3.2.1 Phenetic method

Phenetics (numerical taxonomy), in itself, is concerned with classification by closeness of resemblance between species. The methodology of phenetics is based on concurrent observations of extant species' phenotype and involves the identification of characters and determination their states for each species considered. Character states are then used to measure the comparative degrees of resemblance between species and the result can be represented diagrammatically in a single rooted divergent tree like structure called a *phenogram.* One particular problem in phenetics is that there are many parameters and algorithms to chose from: choice of characters, estimation of taxonomic resemblance, weighting, coding and scaling, and eventual depiction.

Sneath and Sokal (1973) go into *Numerical Taxonomy* in great depth describing the many variations available. Generally, the taxa are first characterised (as a matrix) then resemblance between taxa are calculated using *similarity coefficients* from which the phenogram can be drawn. Of the broad classes of similarity coefficients, the association coefficients *'measure the agreement between pairs of OTU's [operational taxonomic units] over an array for two state or multi state characters'* (*ibid*, p129). The problem is that there are a huge number of, often mathematically related,

variants; Sneath and Sokal give preference to the simplest ones as briefly reviewed here before selection for translation.

The coefficient of *Jaccard*[50], S_J and its variants, considers only where characters positively match by omitting negative matches. Two OTUs that share a common character would be closer than two that lack a common character; Sneath and Sokal consider this philosophically objectionable.

The *simple matching coefficient*, S_{SM}, on the other hand is a ratio based on both positive and negative character matches, and so the common absence of a character becomes significant. The Hamming distance is an absolute complement of simple matching (See Appendix B). As pointed out (*ibid*, p133) '*because* S_{SM} *approximates to a binomial distribution, high values of this coefficient have very low variances.*' which can be ironed out, if need be, by mathematical transformations beyond the aspirations of the present research.

The *Yule* coefficient S_Y balances matches against mismatches and gives a figure between –1 (no matches at all) to 1 (perfect character match) but has had little employment in numerical taxonomy.

While the above consider two state characters (absent or present) more sophisticated methods, such as *the general similarity coefficient of Gower*, are capable of handling two-state, multi-state and quantitative coding.

Given the variety, the question is: which is best for a given application? Sneath & Sokal recommend the simplest be chosen for ease of interpretation:

> we favour ... a similarity coefficient based on binary coding of the data not only because of its simplicity and possible relationship to information theory but also because if the coding is done correctly, there is the hope that similarity between fundamental units of variation is being estimated. There are also the obvious relations of such similarity measures to natural measures of similarity or distance between fundamental genetic units. – [Sneath & Sokal, 1973: p147]

[50] AKA Sneath

A second set of options in phenetics that need to be assessed revolve around the clustering strategy employed. Although, Sneath & Sokal, point out eight aspects of clustering, they note that the most frequently employed strategy is *sequential, agglomerative, hierarchic, non-overlapping* clustering (SAHN) which provides a branching structure. Within this, there are various methods of linkage between clusters: *UPGMA* is unweighted pair group using arithmetic averages wherein the value of a cluster is the mean of its members; *WPGMA* is a weighted version which distorts the relationships in favour of the most recent OTU; *UPGMC* and *WPGMC* are unweighted and weighted centroid methods but produce *reversals* which are unacceptable. There are other more complicated clustering methods. UPGMA is the choice as it is simple, effective and produces less distortion.

A third consideration is the representation. It is possible to depicts phenetic relationships using skyline plots, contour diagrams, ordination plots etc. as a comparison to a tree is required then depiction as a tree is most suitable.

2.4.3.2.2 Relationship between phenetics and phylogeny

It is possible to apply methods of numerical taxonomy to any suitable data in order to produce a tree, even if erroneous or for that matter randomly generated[51]. Phenetics is neither based on historical information nor assumes phylogeny *a priori*; it simply goes on current appearances. A phenogram therefore, is not a phylogram. They do however become related by an auxiliary assumption that *character resemblance is due to inheritance with modification* and therefore traces descent. The problem with this inference is under conditions of convergent or parallel evolution hence, where phylogeny is to be reconstructed, then other factors must be taken into consideration.

2.4.3.2.3 Organisational phenetics

The basic algorithms of phenetics are, in themselves generic mathematical constructs of resemblance un-associated with any specific application and therefore can be applied to any suitable dataset, including that of a group of organisations, without adaptation to produce relevant results (Sneath & Sokal, 1973). Many of the weaknesses of the proposed methodology (§2.4.2.6) are inherited from phenetic

[51] As was performed in some of the testing stages of MENDEL

method. At this stage in memetic research, adjustments to distortions using complicated mathematics should be postponed; as the test is for feasibility rather than accuracy, more sophisticated strategies can be explored as the field progresses.

Simple matching (ie Hamming distance) is chosen as the association coefficient; Jaccard is rejected as absence of characters might be significant (the absence of papal authority in the study); Yule has had little application; and Gower, although highly generalised, is far too complicated. UPGMA is chosen as the clustering strategy for reasons noted previously.

The main issue in considering organisations as operational taxonomic units is that of attempting objective characterisations of intangible entities consisting of sociological properties. Importantly, following McKelvey (1978) phenetics offers polythetic taxonomy of routines & competences etc. The method, however, isn't aimed at producing definitive phylogenies but rather in confirming a mechanism of inheritance. For this reason, it is only necessary that identification of characters is consistent between organisations.

Providing that sufficient common characters and their states can be ascertained then clustering algorithms and phenetic methods, are independent of what sample they are applied to; they can be generalised to any organisational form. The selected method of phenetic construction is covered in §2.5.4.

2.4.3.3 Comparison of direct and indirect reconstructions

Genealogical and phenetic iterations are independent and based upon very different assumptions, methods, and data. Genealogy presents a synchronic historiography showing the ancestral descent of trait inheritance. Under the methodological assumptions and suitable pilot selection, a single rooted divergent phylogram can be used to depict the result. Phenetics, on the other hand, may be regarded as structurally reconstructing history from a contemporaneous diachronic snapshot in time (§1.2.1.3.3); a phenogram similarly depicts the single rooted divergent relationships. However, introducing the idea of inheritance with modification unites them together. Hence, if the independent reconstructions concur then there is reason to suspect a mechanism of inheritance (subject to the criteria in §2.4.2).

The direct phylogeny generated through the genealogical method should produce a reliable tree, subject to the accuracy and completeness of historical archives. The phenogram, in contrast, is not a phylogram in itself but a chart of resemblance. Discerning the presence of an inheritance mechanism demands that closeness of relationship by descent between taxa corresponds to closeness of their resemblance. Hence, *phyla* (clusters of taxa in the phylogram) should resemble *phena* (phenogram clusters) and the closer they match the more congruence can be read into it. Where the phenogram is congruent with the phylogram (Fig. 2-14) then there is a likelihood that characters are inherited between organisations and the meme hypothesis is supported. As stated, the problem lies with the absence of a metric of tree similarity between phenogram and phylogram, and so a subjective appraisal is required.

Testing for congruence can be generalised to any set of taxa (ie organisations) providing it is possible to apply the phylogenealogical and phenetic methods as discussed above. It is conjectured here, that if a phenomena meets the criteria for the presented methodology then a replicator may be implicated.

2.5 Constructing the Method

The methodology has suggested that congruence between genealogical and phenetic iterations on the organisational domain would indicate that memes convey traits. In this section, specifics of the methods will be detailed with respect to their organisational application. Specific application of any component of the method outside of the study may require certain idiosyncratic modifications. The issue of application to the test group however, will be left to the relevant sections in part 3.

2.5.1 Overview of method structure

The method is decomposed into actual procedures for data gathering, processing and analysis. A summery is presented here and each process will be covered in turn.

2.5.1.1 Method summary

There are three stages of common data gathering, construction and comparison. The second stage splits into two independent strands of direct and indirect construction. The overall structure is as follows (Fig. 2-15).

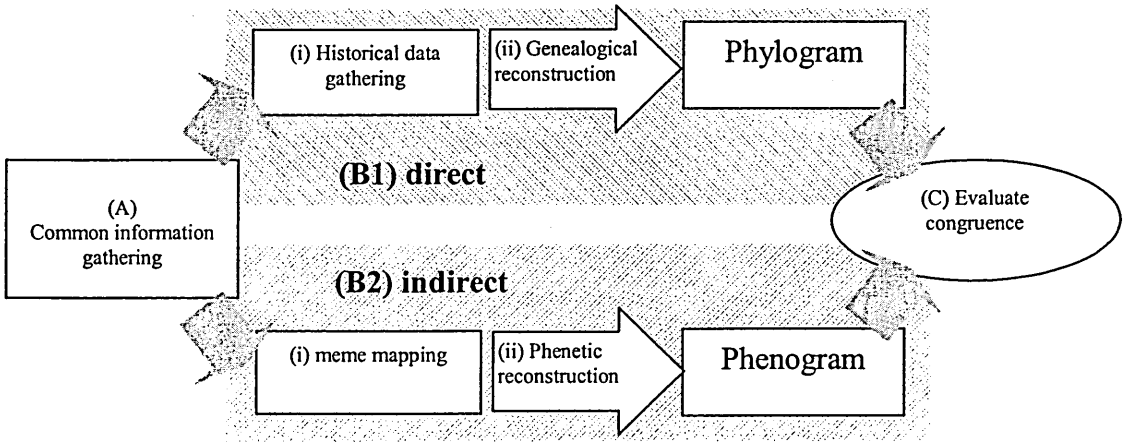

Figure 2-15. Structure of method showing parallel central stages

A Common information gathering

i. *Sector survey* Involves general data gathering, identification of the range of organisations in a particular sector, and the scope of the data available for use in both construction of the phylogenic tree and the phenogram. Provides data sources for later more detailed investigation.

ii. *OTU identification* From the general data gathered, it is possible to identify various individual organisations in a sector for later investigation and analysis. These constitute the *operational taxonomic units* and hence must be uniquely identifiable.

B Phylogeny reconstruction

1. Direct genealogical reconstruction

i. *Historical data gathering* More detailed information is gathered about historical and formative events affecting the each organisation in the study. Data that accompanies significant dates, especially inception and demise are sought at this point along with the influential people, their attitudes and backgrounds. Especially valuable is any information that states direct emergence of one organisation from another. The generation of a timeline also assists in developing the historical picture of the selected organisational sector.

ii. *Genealogical reconstruction* The ancestral relationships between organisations are identified and collated as a table. A genealogical tree depicting actual patterns of descent is constructed and represented graphically by a *phylogram*

2. Indirect phenetic reconstruction

i. *TCM assignment - meme mapping* A set of organisational traits are identified and for each organisation, the state of each character is determined and mapped as a *meme strip.* The collection of meme strips constitutes a *taxa character matrix* (TCM).

ii. *Phenetic reconstruction* Cluster analysis is applied to the meme strips in the taxa character matrix and a pattern of phenetic resemblance is depicted as a *phenogram.*

C *Evaluate congruence* The phenogram and phylogram are arranged so as to facilitate their comparison leading to conclusions about the memetic hypothesis.

2.5.1.2 Method order

There is some dependence in the order of the stages:

i. While independent, the alternate strands of phylogeny construction must operate on the same set of OTUs hence OTU identification must precede both methods.

ii. Both methods of construction must precede comparison of the results.

iii. As alternate methods of phylogram construction are independent then their order is methodologically irrelevant. It is probably advisable to perform the genealogy ahead of the phenetics on the grounds that the archive data also points to sources whereby characters can be established.

2.5.2 Common information gathering (A)

The method splits into two independent strands and then reconverges. The two strands are based on some common information (such as the organisations that both methods operate on) and therefore this must be gathered first.

2.5.2.1 Sector survey (A-i)

As with most voyages of discovery, the early phases are the least methodical and rely more on serendipity and observation than on adhering rigidly to a fixed plan. For the most part, this phase involves scouting around to see what kinds information are available on the chosen organisational form and determining what may lead to something more informative later on[52]. Though specific information is not being sought at this stage, it is a good to make a note of which sources are rich in historical ancestry and characterisation.

The main benefit of such a search is that is provides a general indication of the range, type and quality of information available. Furthermore, it should begin to illuminate some of the candidate samples of organisations within the sector under scrutiny. To a large extent, it is wise not to impose too many restrictions upon the information being sought. Creating an element of randomness and pursuing lines that seem interesting or

[52] This aspect of the method may be likened to grounded research (Glaser and Strauss, 1967; Strauss and Corbin, 1990) in that it is not immediately directed towards a given hypothesis, but rather is a qualitative approach to developing theoretical sensitivity to the problem domain.

engage curiosity is a good way of stumbling upon leads that a more formal plan may overlook or miss entirely.

There is a valid methodological reason for instigating creativity and randomness in such a search. The methodology of genealogy guarantees the existence of an ascendant lineage (by definition) whether it can be discovered from historical records or not. It cannot however indicate the presence or absence of descendents or siblings after the time of recording. A bit of creativity in the search, a random walk in descent space, introduces candidate relatives that may otherwise have been overlooked.

Perhaps the most useful medium for such a broad initial hunt is the Internet as this provides rapid access to a plethora of candidate data. The Internet is a very large haystack, which means that there are a proportional number of needles in it. Internet search engines & meta-search engines offer starting points. Unfortunately, as is the nature of the Internet, there is a considerable amount of junk, irrelevances, dead ends, casino or pornography popups, and 404 pages. Search criteria therefore require some careful wording.

Perhaps initially the best pages to find are those that make an impartial comparison the organisations in question, such as a directory. These are particularly valuable if they offer list of links to more specific information, such as the official home page of an organisation, or other directories. Official home pages tend to take a more biased view and tend to link to other pages that support their opinion.

2.5.2.2 Operational Taxonomic Unit identification (A-ii)

Although vernacular terms exist for many species they are prone to ambiguity and confusion. Scientific clarity is usually gained from the Linnean system of classification (§2.2.3.2.1) that not only guarantees a unique designation for each specie but also makes provision for errata and newly discovered species.

Organisational typologies do not carry the rigour of biological systematics and vernacular terms are employed for business communication rather than scientific use (examples in §2.4.1.2). A more scientific model of the abiota demands greater rigour in identifying organisations as OTUs and specificity of nomenclature.

2.5.2.2.1 Long list candidate organisations by vernacular names

Common vernacular labels, are the starting point for a more rigorous classification scheme. Candidate organisations can be found within the general information and put into a list.

2.5.2.2.2 Generate list of unique OTUs

It is essential that the organisations to be included as operational taxonomic units are unique as multiple occurrences of the same individual in a phylogeny are meaningless. Vernacular naming of organisations is un-regulated therefore there is no guarantee of uniqueness. A name may refer to more than one organisation (homonym); conversely an organisation may go by more than one name (synonym) depending upon the data source. In making a rigorous classification, it is essential that there is a one-to-one correspondence between the taxon and its identifier. Fortunately, organisations tend to have an "official" unique name assigned, either by choice or imposed by legislation (eg. by Companies' House). The problem is that this official name may not be the name that the organisation is normally recognised by or ever uses.

It may be that however that the "official" name is cumbersome or inconvenient. An example is[53] that of *'The Church of Jesus Christ of Latter Day Saints'* are more conveniently and commonly known as the Mormons. The word Mormon in common usage however also refers to *'Reorganized Church of Jesus Christ of Latter-Day Saints'* or other splinter groups. Recognition of distinctions between organisations is required to avoid vernacular ambiguities and it is important to be clear about the referent. A further example of the importance of unique naming comes from the study where homonymy presented a problem within the Baptist clade[54].

2.5.2.2.3 Generate primary keys for OTUs

The official name of an organisation is probably the best choice of identifier though where inconvenient; abbreviations or alternative labels may be more useful. The label

[53] The case study in part 3 uses western Christian denominations at its test group (for reasons explained therein). The examples here are selected to tie in with the religious theme.

[54] Which ironically, supports the validity of the methodology.

itself is irrelevant providing that it uniquely identifies an organisation thereby acting as a *primary key*[55]. Choice of something memorable and meaningful, such as an acronym or italicisation[56], allows the organisational reference can be determined at a glance.

2.5.2.2.4 Addition of subsequent OTUs

In practice it is unlikely that a complete list of OTUs will be gathered right first time and so provision is required for addition of OTUs at later stages. Subsequent addition is achieved simply by each newly revealed OTU being checked for uniqueness and given acronym.

The structure of Linnean nomenclature[57] enables inference of taxonomic placement. Although an organisation's name may give some indication as to what they do (how it is classified) this is not guaranteed. The problem being that ranks of organisational classification have vernacular references by loose consensus, as opposed to regulated designations. Hence, organisational typologies tend to be subjective, unscientific and open to debate. For example some would say that the CJCLDS were a church while others would call it a cult. As vernacular classification is unreliable, it should not be taken as definitive but rather, used as a guide for gathering information (internet searching for example).

2.5.2.2.5 End result of taxa identification

By this point in the process there should be a list representing OTUs for phylogeny reconstruction. This can be stored as the row headings of a data table[58], which are expanded upon through later sections of this method.

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[55] A database term used to uniquely identify a record – eg vehicle licence number or NI number.
[56] The previous examples may then become CJCLDS and RCJCLDS
[57] *<Genus> <specie> [<sub-specie>][L.|J.]*
[58] Practically implemented as an excel spreadsheet to enable processing by MENDEL (appendix C)

2.5.3 Direct genealogical reconstruction *(B1)*

The ability to apply this iteration of reconstruction constitutes the first criterion; therefore it should become rapidly apparent whether or not the candidate pilot case is suitable for testing the methodological hypothesis. As the test requires a divergent monophyletic group (i.e. a tree), then each organisation in the sample, except for the earliest common ancestor, should (ideally) have a single identifiable ancestor within the sample.

Given a concise list of unique operational taxonomic units then the next step is to employ *mono-phylogenealogical* method to produce the benchmark phylogeny, which will be depicted as a phylogram. This involves the capture of appropriate data form historical archives and application of the tree (phylogram) construction and amalgamation algorithms.

Again, phylogenealogy may be applied outside the study; as there may be multiple ancestry (etc.) then variations on the method might be required.

2.5.3.1 Historical data gathering (B1-i)

Historical data gathering may be classified into essential data, which are used to construct the phylogeny and must be obtained, and additional supporting facts, which confirm the validity of the essential data.

2.5.3.1.1 Essential Data Requirements

As the objective is to construct an organisational "family tree" then data capture should be focussed on this task. The minimum data requirements for each OTU are:

- the name of the OTU itself (established in the previous stage) and
- the name of the OTUs parent (except the root) which must exist in the list.

The parent might not currently be found in the list and so, to meet with the second criterion, missing OTU need to be found and added (§2.5.2.2.4 provides guidelines).

2.5.3.1.2 Supporting facts

Acquiring additional information is performed with an eye for the historical events that shaped the development of the organisation. Internet searches are as simple as adding '+history' to the search criteria and highlighting dates in documents.

Fortunately, organisations seem keen, indeed proud, to record important events and biographies of key people in their history. Though the interpretation of events, as recorded by an organisational insider, may be coloured by that perspective, there tends to be negligible discrepancy about names and dates irrespective of whether the source is protagonistic or antagonistic.

Particular attention should be given to the origins of the organisation:

- Dates, geographical locations, concurrent events & issues
- Circumstances in which the organisation was formed
- History, education, struggles & attitudes of the founders
- People who influenced them (parents, teachers, mentors, friends)
- Organisations that they were previously members and how & why they joined
- Their standing in that organisation and what they did while they were there
- Disputes they had and circumstances under which they left and
- Why they decided to form another organisation.

The dates are important in terms of confirming organisational ancestry on the grounds that an ancestor should be in existence prior to formation of a child organisation.

2.5.3.1.3 End result of historical data gathering

The OTU-parent pair list constitutes the directly constructed organisational phylogeny that can now be depicted as a phylogram. Notably the root and only the root should be without a defined parent.

2.5.3.2 Genealogical reconstruction (B1-ii)

The purpose of tree construction is to provide a graphic representation of the actual organisational phylogeny against which the phenogram can be compared thereby enabling evaluation of the hypothesis of inheritance. Where the dataset is large then the phylogeny may be decomposed into smaller trees. The basic principle is straightforward and involves iterating each OTU and joining it to its parent (provided in appendix A). The end result is a phylogram (or perhaps a "phylogenealogical tree") that may resemble the example in Figure. 2-16, though more detailed. For the

purposes of the study, this *phylogram* can be used as a comparison for the *phenogram* constructed in the next section (§2.5.4).

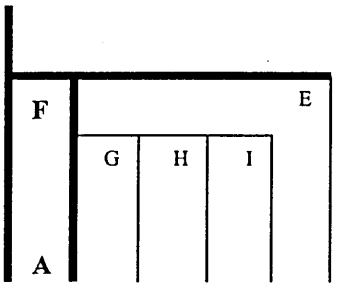

Figure 2-16. Example phylogram

2.5.4 Indirect phenetic reconstruction *(B2)*

The methodological hypothesis (§2.4) argued that organisations with close phylitic relationships should bear a phenetic resemblance. The previous section examined how to reconstruct a reference phylogeny directly from historical archives of organisations. Here, the second independent ahistorical organisational trait based iteration of reconstruction will be detailed; for the study, this meets the second criterion. The two major stages are data capture of organisational traits, and phenetic reconstruction of organisational resemblance based on these traits. Sneath & Sokal (1973) have provided an extensive appraisal of *numerical taxonomy* (the major considerations have been covered in §2.4.3.2.1 to §2.4.3.2.3) so only specific process application to the abiota will be considered here.

The process of clustering is very general as it can be applied to any phenomenon, including organisational taxa, provided information is available about the characters and states. The result of the process will be a tree like *phenogram*, which shows the apparent resemblance between chosen organisations; it will not show a pattern of decent, that is provided by the phylogenealogical iteration.

2.5.4.1 Taxa character matrix assignment - meme mapping (B2-i)

One organisation may posses certain characteristic whereas another may not and this is how we distinguish between them. This section of the method is concerned with identifying important traits (with reference to set criteria) and determining, for each organisation, whether it exhibits a trait or not. Abstractly, given a set of OTUs and characters, for each OTU, the state of each character needs to be established. Clearly

this forms a matrix between the taxa (rows) and the characters (columns) where the Boolean value of the intersection (cell) represents the state. This *taxa character matrix* (TCM) constitutes the basic data object[59] for subsequent phenetic processes and will resemble Table 2-2.

TCM assignment may also be thought of as *meme mapping* although the hypothesis is presupposed by the term. If abiotic characters (i.e. routines & competences etc.) are inherited and the meme is the mechanism of inheritance then the ability to establish the state of each inherited character for an organisation constitutes the mapping its putative memes whereby each row of the TCM represents an organisation's meme strip[60] (as a Boolean tupple).

2.5.4.1.1 Selection of characters

The first step in TCM assignment is to list and define a set of characters based on prescribed criteria. As to what constitutes an organisational character is the most subjective aspect of the program on the grounds that intangible complexed social entities have evaded the rigours of natural science. Every effort needs to be made, therefore, to eliminate bias and preserve as much consistency as possible.

The problem of what and how many characters to consider is evident in biological phenetics. Sneath & Sokal (1973) suggest that the consideration of all characters would be the ideal, however practicality necessitates that restrictions are imposed. The real difficulty with introducing more characters is that of time and effort involved in establishing their states especially when they are yielding no useful distinctions.

Table 2-2. Example taxa character matrix (TCM)

	Character 1	**Character 2**	**...**	**Character n**
Organisation 1	0	1	...	0
Organisation 2	0	1	...	1
...	...	...	...	...
Organisation m	1	1	...	0

[59] the TCM data object is conveniently implemented as a Microsoft Excel spreadsheet and interfaces directly with the MENDEL software (Appendix C).

[60] "Strip", as opposed to "string" is used as string is a reserved word in Visual Basic and another variable name had to be found, as a meme, the "strip" stuck.

In biology, taxonomic characters can be grouped roughly into[61] morphological, physiological & chemical, behavioural, ecological and distributional. These characters groupings have analogues in the organisational domain and therefore provide clues as to what might be placed in the column headings of the TCM. Perhaps the most useful, in terms of organisational study are the morphological and behavioural.

In the present scheme, all characters are Boolean (either a given organisation has that character or not). Absent data or no comparison are inadmissible[62] as this results in unwarranted comparisons. Qualitative multi-state characters must be enumerated or otherwise rendered into an admissible form. Such methods of *coding and scaling* described in Sneath & Sokal (1973).

The method chosen herein establishes characters from the literature, rather than from primary data, as this approach allows a wider and more geographically disperse set of organisations to be examined. Documentation is scanned to identify gross and obvious features, which are placed on a list of candidate characters. Character columns headings are entered on the TCM (ready for assigning states) and their meaning explicitly defined.

During the course of research, some characters may become redundant and can be deleted from the TCM. On the other hand important new characters may come to light and thereby will require defining and adding to the TCM. Although the character order is irrelevant, in practice, it is convenient to keep related characters close together.

2.5.4.1.2 Assignation of states

The TCM now possesses heading and requires populating whereby the state of each character needs to be determined and entered at the relevant intersection in the matrix. This continues until the matrix is complete.

[61] Sneath & Sokal (1973) p90

[62] Though alternative phenetic assumptions may be made to accommodate them, these were not used in the current method.

As the characters states are Boolean then it is admissible to use any representation that represents absence or presence (such as "-" or "+", True or False etc...). It is convenient, however, to use 0 and 1 as these facilitate computation and is implemented this way in MENDEL. There is a third state ("") whereby a character remains to be assessed. For the TCM to be complete all of these unknown states must be resolved.

The current research revealed some practical difficulties that are mentioned here as their resolution demanded adaptation of the method. A problem with secondary narrative data is that its authors' agenda and focus gives emphasis to blatant organisational features to the detriment of others. In order to complete the matrix, a decision has to be made on how to resolve omission of facts. One approach was to seek other sources and more in depth information, which explicitly state the presence or absence of the character in question. Invariably, however, deeper searches lead to more discursive material and so it became necessary to "read between the lines" picking characters from context or deducing a character from multiple sources.

2.5.4.1.3 End result of meme mapping

By this stage in the method, there should be a fully populated taxa character matrix (possibly a spreadsheet) that resembles table 2-2. The data set is now is ready for phenetic processing.

2.5.4.2 Phenetic reconstruction (B2-ii)

The resemblances between pairs of organisations can be calculated from the data in the TCM and their relative proximities to be depicted as a *phenogram* tree. There are three sets of assumptions to be made: (i) the method of establishing resemblance, (ii) the clustering strategy of *phenons,* and (iii) the way that the phenogram is portrayed. The phenetic assumptions in this research have made out of simplicity in order to meet the primary purpose of evaluating the methodology and hypothesis. Although minimally complex algorithms are chosen, other variations may be the focus of future investigation.

2.5.4.2.1 Association co-efficient and Hamming distance

Phenetics has produced a range of measures called *association coefficients* that are ratios of similarity between OTUs. A problem of choice arises however.

> ... numerous association coefficients appropriate for binary data are described in various reviews... Many of these have been applied only rarely (often just once in the original paper proposing their use)[63].

In keeping with Sneath & Sokal's (1973) recommendation of simplicity in choosing an association coefficient, this research has based the distance between the characterisations of two taxa directly on Hamming distance (H_d), which is a variant on the simple matching coefficient (discussed in §2.4.3.2.1 & §2.4.3.2.3). In communications, Hamming distance is a metric of digital error that counts the number of places where binary strings differ (Appendix B). Although based on different principles to similarity co-efficients, the hamming distance measures demonstrates absolute difference as opposed to relative similarity[64]. There are reasons for using this.

i. Computationally, it is much simpler and therefore faster as well as easier to implement and test.
ii. It operates directly on meme strips taken from the TCM without further processing.
iii. It is more appropriate for modelling errors in information transmission (i.e. memetic mutation)
iv. It produces the same results as the simple matching coefficient[65] S_{sm}.

2.5.4.2.2 Distance matrix

Any organisation can be compared to any other in order to see how different they are by performing a Hamming distance measure on their meme strips. When each is compared to each other then this constitutes the *distance matrix*[66]. This is almost identical to the table of distances between cities as found in many roadmaps. Most of the matrix is actually redundant on the grounds that

$H_d(a, a) = 0$	the diagonal is always 0
$H_d(a, z) = H_d(z, a)$	distances are mirrored across the diagonal

[63] Quoted by Panchen (1993)
[64] For example Simple matching coefficient (S_{sm}) provides a value between 0 and 1 where 0 indicates that two taxa are entirely dissimilar and 1 that they are identical.
[65] This relationship is shown in Appendix B.
[66] If a measure of similarity is used then it is called a *resemblance matrix*

Hence it is conventional to use only the lower left triangle. As a simple example, consider 3 taxa with meme strips:

A: 0110 B: 0111 C: 1000

Then the distance matrix is calculated as being table 2-3 where the shaded values are redundant.

2.5.4.2.3 Clustering methods

By being able to establish the phenetic distance between any two organisations (given by the appropriate intersection in a distance matrix) then, given a group of organisations, it becomes easy to find the pair, with the closest resemblance (by finding the lowest relevant value in the distance matrix). In the example "A" and "B" are the closest while "C" is fairly far away from both.

Clustering, in the sense used here, involves grouping things by the apparent similarity. Two things in the same cluster should be more similar to each other than to an item in a different cluster. The most frequently employed methods for finding clusters in biological specimens are *sequential, agglomerative, hierarchic, non-overlapping*

Table 2-3 Example distance matrix

$H_d(j, k)$	A	B	C
A	0	1	3
B	1	0	4
C	3	4	0

(SAHN) methods (Sneath & Sokal, 1973), which essentially means that the end result has a treelike structure (§2.4.3.2.1). As with association coefficients, there are many variations and in keeping with the requirement of simplicity, *UPGMA (un-weighted pair-group method using arithmetic averages)* is adopted, as it is probably the most frequently used clustering strategy[67].

The algorithm proceeds *sequentially* by iteratively finding the closest *pair* of items (either OTUs or a cluster of OTUs) and clustering them together as a *phenon*[68]. The distance between two items is the *average* of the distances between the OTUs in each

[67] Simulated weightings in the trial (part 3) later suggested WPGMA may have been better (see part 4)
[68] *Phena* are the groupings of a phenogram much similar to *taxa* or *clada* used in other systems.

item. By the example, "A" & "B" are the closest and so are clustered as "AB". The distance of "C" to "AB" is

$$H_d(AB, C) = H_d(A, C) + H_d(B, C) / 2 = 3.5.$$

Iterated clustering continues until there is just one large cluster consisting of a *hierarchy* of bifurcating sub-clusters.

2.5.4.2.4 Representation of taxonomic structure

The pattern of clustering may be represented as a phenogram, which is a dendrogram depicting resemblances. There are a variety of ways of representing cluster information such as the radial technique of the Wagner ground plan divergence method (Panchen, 1993; also suggested by Wilkins, 1998). The convention adopted here, however, is also that of a "vertical icicle plot" (although the graph may be rotated or flipped as necessary) as this is consistent with the genealogical phylogram. The starting OTUs appear in a row along the lower edge (but not necessarily in their original order); each phenon (OTU or cluster of phenons) is represented by a vertical line. The vertical axis represents the distance between *phenons* and is either an absolute or ratio value depending upon the distance measure used. Where a horizontal line joins two phenons then this is the distance between them. The OTUs are arranged in such a way lines on the graph don't cross (by positioning closely related phenons near to each other).

2.5.4.2.5 End result of phenogram processing

Along with the phylogram directly constructed through genealogical methods, a phenogram should also exist that depicts the pattern of resemblance between the selected organisations. At this point, it is still unnecessary to infer a pattern of descent though this assumption is allowable and will be subsequently tested.

2.5.5 Evaluate congruence (C)

Two dendrogram, a phenogram and phylogram, have been constructed using independent methods and data. In order to test the hypothesis, these should have a

degree of congruence. Consequently, a method of comparing the two representations needs to be provided[69].

2.5.5.1 Problems

There are some issues in comparing the two representations that need to be resolved.

i. During the course of the research no known standard quantitative metric of similarity between two trees was found though graph theory offered abstract proofs of isomorphism. It is assumed, for the purposes of future research, that Hamming distance may also be applied to tree comparison.
ii. From a cluster, it is possible to discern that taxa are related. A phenogram is not a tree of descent however, and asserting how organisations are related ancestrally requires auxiliary investigation.
iii. Automated comparison was not implemented in the MENDEL software owing to time constraints and anticipated complexity of the algorithm (see part 4).

2.5.5.2 Solution

Because of the problems involved in automating the system a manual approach was adopted that required the researchers judgement in comparison. As trees are graphical devices then judgement of similarity would be based on visual impression. The choice of representation, then for both dendrograms, facilitated visual comparison. In practice, generated dendrograms were exported into vector based graphics package[70] where various lines could be moved around the screen or their colour picked manually.

2.5.5.3 Methods

Comparison is made at the "macro" level to assess the overall similarity of the main branches, and also at the "micro" level to ensure that the main branches carried the same "leafs". Initially, major branches on the genealogical phylogram are coloured (in such a way that sub-branches and leafs thereof inherited that colour). The corresponding leafs on the phenogram are given the colour and this is traced back up the tree – where clusters are predominantly one colour, then this is an indication of congruence on the "micro" level.

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[69] Again, performance of a pilot study demonstrated that congruence evaluation was more involved.
[70] Corel Draw 9

Another process, "phenon abstraction", can be used to check "macro" level congruence. Abstraction involves representing all the lines of one colour with a single thick line (of the same colour) on both trees thereby reducing the amount of detail and allowing gross structural features to be examined (these can be seen in Appendix G).

2.5.5.4 Result

The manual method provides a slow but reliable means of judging the similarity of the dendrograms which, assuming diligence in data acquisition and processing, allow the hypothesis to be evaluated.

2.6 Practical implementation

The algorithms of numerical taxonomy have a high degree of computational complexity and, owing to the large data sets involved, can only be realistically achieved through automated processing. There are many software packages available for biologists and geneticists including DNA sequencing, cladistic, distance matrix, including parsimony methods[71]. It was decided that a clean slate was required and specific software should be written for the processing of meme strips: Firstly, a neutral algorithm that clusters without violating criterion 3 (of orthogonal independence); phylogenetic inferences are only to be made *a posteriori* (as per criteria in §2.4.2.3); secondly, much greater flexibility for experimenting with various algorithms was intended (ie not having to work around limitations of biology specific programmes; reasoning is explicit in Appendix C.2.1 & C.2.2); thirdly, this helped the researcher to understand the problem.

The development of MENDEL and EDEN-ML, as tools for analysing and exploring cultural evolutionary lineages, became a significant contribution to the research program. *Memetically Enabled Numerical Derivation of Evolutionary Lineages* provided a convenient means of representing meme strips (organisational traits) within a conventional Excel spreadsheet, allowed for their processing and display as dendrograms. The open architecture of the MENDEL software was also intended for future extended memetic research programmes. Design, implementation and testing of the software is described in Appendix C (see also Garmendia-Doval & Gatherer, 2002[ix]).

Part 3 will demonstrate the application and evaluation of the research method within the selected test group of western Christian denominations.

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i http://skepdic.com/naturalism.html The sceptics dictionary

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[71] http://evolution.genetics.washington.edu/phylip/software.html provides downloads to much software

[ii] http://www.geocities.com/etymonline/f1etym.htm provides an etymology.

[iii] http://www.utm.edu/research/iep/e/extworld.htmThe Internet encyclopaedia of philosophy

[iv] http://pespmc1.vub.ac.be/ASC/HOMOMORPHIS.html Principia Cybernetica: homomorphism and isomorphism http://pespmc1.vub.ac.be/ASC/ISOMORPHISM.html

[v] http://www-geology.ucdavis.edu/~GEL3/selection.html provides an overview of selection topics

[vi] http://tolweb.org/tree/phylogeny.html The Tree of Life project is an ambitious on-line classification catalogue

[vii] http://www.amway.com The official homepage of Amway. Problems with the "plan" are suggested by http://www.amquix.50megs.com/Amway_Real_plan.htm

[viii] http://www.bcg.com/publications/search_view_perspectives.asp?pubID=294 The product portfolio of the Boston Consulting Group

[ix] http://jom-emit.cfpm.org/2002/vol6/gatherer_d_report.html Reporting on the EPSRC Symposium on *Software Evolution and Evolutionary Computation*

Part 3: Trial Application of Research Method Upon Western Christian Faith Groups

America is truly the "paradise" of old world religions that have here found new expressions

Mather and Nichols

Dictionary of religions and cults (1993 p9)

Looking back down the many branches of Christianity, we see a tree called Jesus the Christ. Beyond this trunk, Christianity is rooted in God's call to Abraham in the land of Ur. From the time of Jesus into the 20th century, the roots divided and multiplied, dipping into soils and water foreign to its beginning, affecting its color and character. Throughout its history, however, it never forgot its beginning, even though its memories of who Jesus was and what he taught, waxed and waned through time and place.

The Rev. Epke VanderBerg

The Christian Family Tree[1]

When you are pre-programmed to absorb useful information at a high rate, it is hard to shut out pernicious or damaging information at the same time. With so many mindbytes to be downloaded, so many mental codons to be replicated, it is no wonder that child brains are gullible, open to almost any suggestion, vulnerable to subversion, easy prey to Moonies, Scientologists and nuns.

Richard Dawkins

Viruses of the Mind (1991)[2]

If 'memetics' is to contribute anything significant to what is already well known to anthropologists, sociologists and historians of religion, it will have to be by identifying specific components of different religious 'memeplexes' whose probability of replication can be shown to have been enhanced by specific features of their carriers' environment - a rewarding task, but a very difficult one.

W.G. Runciman

Darwinian Soup: A review of the Meme Machine by Susan Blackmore[3]

[1] http://www.silcom.com/~origin/sbcr/sbcr052

[2] http://www.spacelab.net/~catalj/virus.htm

[3] http://www.lrb.co.uk/v21/n12/runc2112.htm: From LRB Vol 21, No 12 | cover date 10 June 1999

3.1 Application Introduction

The meme has attracted a whole spectrum of interest from the wildest fringe of Internet geeks to serious academics. Unfortunately there has been so much argument as to whether or not memetics could be a science that actually making it so has been sidelined. Memetics has become a self-confessed bandwagon, laden with theory but with little empirical fuel (De Jong, 1999). The danger is of becoming stuck in the mud and marginalised as a quaint quasi-scientific curio. Hull's call to action is reiterated – it is time to move into new era of empiricism.

3.1.1 Objective and structure of this section

The survey of historical and contemporary theory (Part 1) formed the basis for rationalising both the organisational "gene" and methodological hypotheses (Part 2). The objective of the research is to demonstrate the possibility of an organisational memetic methodology; in order to avoid remaining an untested abstraction and according to the criteria laid out then *it is necessary and sufficient to perform a single pilot study*. This section moves into the inductive phase of applying the method in order to gather and analyse evidence.

Testing the methodological hypothesis on a pattern of descent required the following:

- Firstly a test group was required and western Christian denominations were selected from a list of candidates through applying general choice criteria.
- The fissiparous nature of western Christianity has attracted much study and existing literature, as reviewed, provides a rich and accurate data source. The current research method will be contrasted against more orthodox approaches to comparative religion and specific methodological considerations with respect to communities of faith are made.
- The method is then applied and the intermediate stages of both the genealogical and phenetic iterations are represented along with the final test for congruence between phenograms. During the research process, certain interesting and unexpected observations about Baptists and Bishops became apparent. These were consistent with a memetic explanation.

While analyses specific to test groups are presented here, Part 4 will go on to provide a more general account of the results in terms of the theory of memetics.

3.2 Selection of a test group

The range and complexity of human social constructs is daunting. It is therefore useful, while establishing the viability of the method, to target an appropriate test group using criteria that eliminates as many unnecessary variables as possible and reduces noise. Ideally there should be some "clean strain" for experimental purposes but unfortunately, no organisational equivalent of *Drosophila melanogaster*[i] has been bred under laboratory conditions. A choice has to be made as to the most suitable form from what is available. By setting criteria, several candidates reveal themselves Western Christianity is chosen as it not only has been the subject of prior memetic analysis but also is the clearest example of memetic spread. Within the confines of the study, it is minimally necessary to test the methodological hypothesis on one group. Given the resources then other tests, including a negative case (see part 2) would be advantageous.

3.2.1 Selection criteria

The isomorphic proposition stemmed from common observations that both biota and abiota exhibited (a) environments, (b) traits, (c) diversity, and (d) viability (§2.2.2), which lead to both the rational hypothesis of new constituents of the abiotic model (§2.3.1). In particular the methodological hypothesis was enabled by recognition of organisational traits and commercial diversity.

These following criteria may be used select a group whose information is available and amenable to translation such that both strands of the analysis (phenetics and genealogy) yield comparable sizes and their degree of congruence can be established. The first three of these criteria are deemed absolutely necessary while the latter two are complementary; they assist in the understanding evolutionary phenomena. Some elements of information may be more available than others in certain organisational sectors and so a trade off may become necessary.

3.2.1.1 Sufficient historical records

The first criterion for the methodology was the ability to reconstruct descent directly from historical evidence without regard to traits (§2.4.2.3). To facilitate the first iteration of phylogenealogy on historical data (§2.4.3.1), it is essential that accurate chronologies exist of the organisations identified. Minimally, this requires some indicator as to the parental organisation for each one (Appendix A.3). However, accurate detailed information with dates, places, events and people, consistent from many sources and preferably in convenient tabulated form that fits into a spreadsheet is the ideal. This allows for additional verifiability based on historical presidents, across the reconstructed phylogenic tree.

3.2.1.2 Distinguishable characteristics

The second criterion: an iteration of indirect reconstruction of the phenogram, necessitates access to information about each organisation's characters and their states (§2.4.3.2). The more characters there are available the more detailed the distinctions will be thereby conferring accuracy in the tree. The main issues are those of character information availability and accuracy and complexity of processing involved with the introduction of each new character. Ideally each character should be relevant to each organisation and have information available to its state for each. Choosing a group in which obvious differences are noted is a good starting point (Sneath & Sokal, 1973).

3.2.1.3 Wide ranging diversity within the group

Taxonomic classification and phylogenic reconstruction is simplified for biotic groups that have a wide range of closely related, albeit distinguishable species. More importantly, this provides better scope for revealing a more reliable pattern of descent: the probability of a random match between iterations dramatically decreases. Beetles are a frequently cited case as order Coleoptera consists of around three hundred thousand species (Freeman, 1972). Corresponding *abiodiversity* is the methodological enabler (see §2.4.1.2) as, although there will be a characterising feature common to the group, the clarity of relationship by descent arises from variety within the group. The measure of this is not the number of individual organisations but uniquely distinguishable "species" of organisation (McKelvey, 1978).

3.2.1.4 Prominent belief systems

While the method should generally applicable to any abiotic group, the presence of a replicating informational substrate (Gabora, 1997) is more evident where it is acknowledged that information or belief is accepted for the sake of itself. This emphasises the memetic element by reducing contaminating factors.

3.2.1.5 An evolutionary bloom

The fossil record is characterised by bursts of evolutionary radiation following mass extinctions, the opening of new territory or the development of new biotic capabilities. The Burgess Shale (Gould, 1989) provides a famous example of the last while the Galapagos Island Finches (Darwin, 1859) are the most famous example of radiation into new niches. Though this is not an essential criterion for selection of a group, when making the choice an indication of this pattern allows for contemplation of phylogenic scenarios. Should punctuated equilibrium be suggested in a pattern of organisational descent then this would support the evolutionary claim.

3.2.2 Candidates

By the above criteria a few organisational forms present themselves as candidates. Although western Christian denominations were selected for the present test, the others are suggested for future research (Part 4).

3.2.2.1 Business fashions / fads

The rise and decay of managerial fashions / fads (Pascale, 1990; Abrahamson, 1996) can be interpreted from a memetic stance (Price and Shaw, 1996; Price, 2000). Successful fads sustain an emergent, 'organisation' of institutions whose existence depends on the continued propagation of the fad concerned. The 'organisation' is however only a loose federation of different groups whose common element may be no more than a single term, for example Quality Circle (Abrahamson *op cit.*), Business Process Re-engineering (Price and Shaw, 1996), Learning Organisation (*ibid*; Scarborough and Swan, 1999).

3.2.2.2 Professional bodies and professions

It is possible to consider different fields and paradigms of scientific endeavour as emergent organisations whose codes of behaviour replicate the discipline / paradigm

concerned (Hull, 1988) and a similar case seems makeable for professional bodies. In the UK Surveying has captured the niche for assigning values to many forms of property transaction, including fine arts. In continental Europe the profession has no equivalent and others occupy the comparative economic niche. Facilities Management (FM) in the UK is a business fashion currently seeking to establish professional status (Green and Price, 2000; Price, 2000). The historical antecedents of professions are however less easily established.

3.2.2.3 Martial arts

There are reputed to be over 1500 Chinese styles alone (additionally Japanese, Korean and modern American descendents as well as Indian/Greco-Egyptian ascendants), which have both characterising properties and have geographically & historically traceable relationships of descent (Shaolin Gung Fu Institute[ii]; Yang Jwing-Ming & Bolt, 1982; Wong Kiew Kit, 1993). The memetic codes remain to be documented.

3.2.2.4 Manufacturing technology

Given McCarthy et al's (1997) demonstration of the possibility of constructing cladograms of manufacturing technologies the method being tested here might, if successful, have applications in fields of organisational change and strategy. The memetic codes are however at least an order of magnitude more complex (Appendix J goes one step beyond).

3.3 Religion

> The term for religion in China, *tsung-chiao* refers literally to a *tsung* or lineage of *chiao* or teachings.- [Smart, 1998 p445]

The structure of religion and that of western Christianity particularly provides a suitable test bed, as judged by the criteria provided, for evaluating the methodological hypothesis. The method prescribed in part 2 can then be applied to Christian groups. Before doing so, it will be worth contrasting orthodox approaches to comparative religion against memetic ones.

3.3.1 Western Christianity as the target group

Each of the criteria was clear when choosing western Christian denominations as the ideal test group. However, this group held particular merit because of the emphasis on faith, which has long been an area of curiosity for memetics.

3.3.1.1 Sufficient historical records

The history and formation of better known and later Christian sects tend to be well documented from within and include information such as dates, locations, congregation sizes, deeds, influential people and their history and the context surrounding formation. Additionally, secondary analysis from outside the church's organisation, is frequently available (eg. Thompson, 1985; Mather & Nichols, 1993; Mead, 1965; Burgess & McGee, 1988; University of Virginia[iii]). From these we can construct the phylogenealogical iteration.

3.3.1.2 Distinguishable characteristics

The characteristics that differentiate a particular cult or sect tend to be gross and apparent and have been examined by scholars of comparative religion (Farrington, 2000; Smart, 1998; Whiting, 1983; Parrinder, 1965). The characters chosen are at the discretion of the individual writer; these may be inconsistent between authors. Lesser characteristics, however, may be more difficult to discern. Many religious organisations publish statements of belief and make the direct distinction between themselves and others (eg. The Watchtower Bible and Tract Society). From these we can construct the phenetic iteration.

3.3.1.3 Wide ranging diversity

The great religions of the world span from Jewish-Christian-Islamic monotheism to the polytheistic systems in the east (Whiting, 1983; Parrinder, 1965)[4]. Christianity in itself is highly diverse and spans from Roman Catholicism and Eastern Orthodox to many lesser-known sects and cults (Mather & Nichols, 1993; Mead, 1965; Burgess & McGee, 1988). Religious history in the west since the reformation has seen the formation of many new groups of Protestants as internal disagreements on various issues have produced splits.

[4] And many more in-between and outside

The pie charts gives (Fig. 3.1) approximations of the numbers of adherents to the major groupings[iv].

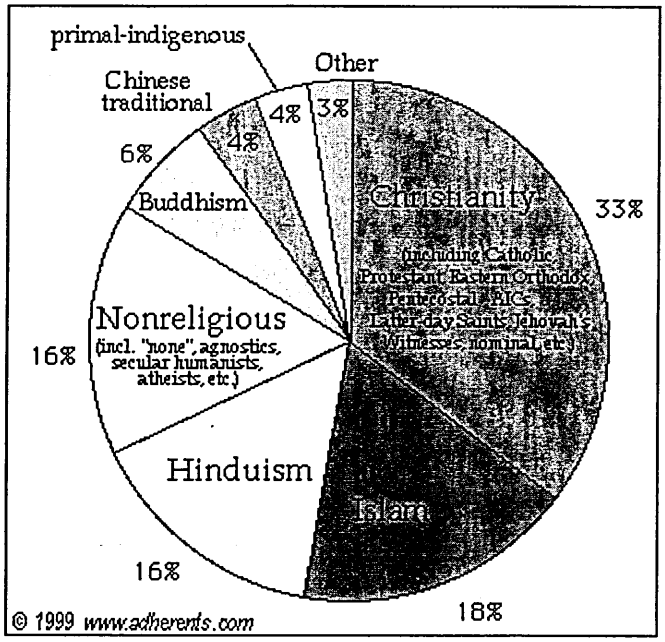


Figure 3.1. Percentage of Adherents by faith

3.3.1.4 Prominent belief systems

Religion[5] is closely associated with the acceptance of certain belief systems. Evangelicalism is concerned with spreading faith in Christ, as the sole route to salvation, according to inerrant Scriptures (Sproul, 1988; Howe, 1991) and at the pinnacle are prosalytic sects such as the Jehovah's Witnesses. Faith diffusion is intrinsically suggestive of a memetic replicator and reflects the 1622 Vatican council's name "*Congregatio de Propaganda Fide*"[6]. Dawkins (1993), famously has attacked the religious *virus of the mind* and others writers have considered the spread of faith through a memetic lens (Brodie, 1996; Lynch, 1996; Blackmore, 1999; Piper, 1997; Gottsch, 2001; Pitt, 1998.)

3.3.1.5 An evolutionary bloom

Cursory examination of Christianity both before and after the reformation shows the branching pattern due to various heresies, interests, interpretations and opinions. Particularly, the European settlement of North America has some parallel with the

[5] philosophical or otherwise

[6] Congregation for the Propagation of the Faith – (Encyclopaedia of Psychology: Neubauer, 1972) was founded as a commission to disseminate faith in newly-discovered heathen countries (Dictionary of Christian Theology: Richardson, 1969).

arrival in the Galapagos Archipelago of the original parent finches. New territory opened for settlement offered many new niches in which different religious groups could thrive (Mather & Nichols, 1993).

3.3.2 Omission and inclusion criteria

While the diversity criteria (§3.2.1.3) is met through religion, the focus is upon western modern (post-reformation) Christianity, as opposed to early eastern schism, on the grounds of availability of information – being recent, in English and on the Internet. Notable omissions are where information is sparse for example in extinct, minor or eastern forms. Furthermore, cults and sects that are esoteric hybrids and outside the normally accepted definition of Christian (such as the Mormons) will not be included in this study but are recommended for inclusion in future updates of the research. Parachurch organisations[v] are also omitted. Clearer guidance to taxonomic units are given later (§3.4.2.2)

3.3.3 Methodological considerations

Before applying the method to Christendom, it is worth noting its relationship with the very extensive corpus of knowledge currently in existence along with the view memetics takes of faith. Emphasis is given to rendering the method applicable to the specific topic of religion wherein various observations are anticipated.

3.3.3.1 Comparative religion

The corpus of literature in Christendom is vast and exists in numerous forms, which are of course based upon the testaments of the bible[7]. By far the bulk, other than proprietary pamphlets and magazines, is concerned with theological *content* of scriptural commentary or dogmatic theology, apologetics, explanation and interpretation. Such content is largely irrelevant to the current study.

Comparatives, on the other hand, tend to *contextually* describe the salient features of the major world religions (Farrington, 2000; Smart, 1998; Whiting, 1983; Parrinder, 1965) or more parochially, interdenominational aspects (Thompson, 1985; Mather & Nichols, 1993; Mead, 1965; Burgess & McGee, 1988; France, 1982). A second form

[7] Of which (after Wycliffe) there are several English translations including the New World Translation that supports views held by the Jehovah's Witnesses.

of comparative religion carries the theological agenda antagonistic to fringe denominations and either rationally reveals their unscriptural foundations (Bowman, 1995; Berry, 1987, 1990; Rhodes, 1995; Beisner, 1998) or takes on sensationalist anti-cult[vi] styles (Boyle, 1995; Tucker, 1989; Moran, 1999; Hutchings, *s.d.*).

As a cultural phenomenon, religion has attracted sociological treatments also (Weber, 1966, 1970; Durkheim, 1961; Gertz, 1964, 1966) that have considered non-metaphysical themes as ideology, ritual & institution, authority, power & politics, education, class & social control (Thompson, 1985; Roucek, 1956; Laqueur, 1976, Marx & Engles, 1957).

3.3.3.2 Existing typologies and taxonomies

Although a few authors and sociologists have attempted definitions and made distinctions of sociological items such as cult, religion, faith and church, the majority of terminological usage is vernacular. Rigorous typologies and taxonomies have been attempted however, and these contribute to the present study. Wilson (1969) provides a seven-fold[8] *typology of sects,* which is a monothetic scheme based upon a group's dominating reaction to the world. Although social scientists do employ definitions for church, denomination, sect and cult, such terms are often value laden and are used to convey an author's agenda, which has lead to preference for the term *new religious movement* (although the majority of NRMs are not actually new). Foster (1995[vii]), on the other hand, provides a typology of religious organisations[9] with the objective of reducing the Christocentric bias.

When comparing faith groups the first thing to note is the ambiguity over the term *denomination.* Classification forms a divergent agglomerated hierarchy as by adherents.com[viii] whereby for a example [Presbyterian] individual:

1. This person's *religion* is Christianity.
2. She is part of the Protestant *branch* of Christianity.
3. She is Presbyterian. Presbyterianism is a *denominational family* within Protestantism.
4. The Presbyterian Church (U.S.A.) is the *religious body* (or denomination) she belongs to.
5. Finally, the Oakview Presbyterian Church is the *congregation* she attends.

[8] Wilson's (1969) typology covers: Conversionist, revolutionary, introversionist, manipulationist, thaumaturgical reformist and utopian.
[9] Foster's (1995) typology has 3 basic sub-dividable groups: Normativist, Arcanist and distinctivist.

Hence the prescribed *ranking* scheme (following from §1.1.5.2 and used in §3.3.3.4) would be religion, branch, denominational family, religious body, and congregation. In order to avoid ambiguity and pejorative associations, this ranking scheme is chosen for the study.

Comparative religion (between Judaism, Christianity, Islam, Baha'i, Buddhism, Shinto, Taoism) usually operates at the highest rank of *religion* (Whiting, 1983; Parrinder, 1965 etc.). The *branches* represent the major schisms (Eastern orthodox, Coptic, Roman Catholic, Protestant) in the Christian body. At the rank of *denominational family*, Melton (1996[ix]) organises religious groupings in the United States into twenty *families*[10] (detailed in Appendix D).

Study includes	Study omits
Western Liturgical	Eastern Liturgical
Lutheran	Eastern Family
Reformed-Presbyterian Family	Middle Eastern Family
Pietist-Methodist Family	European Free-Church Family
Pentecostal Family	Holiness Family
Baptist Family	Independent Fundamentalist Family
Adventist Family	Communal Family
	Latter-day Saints Family
	Christian Science-Metaphysical Family
	Spiritualist, Psychic, and New Age Family
	Ancient Wisdom Family
	Magick Family
	Unclassified Christian Churches
	Unclassified Religious Groups

Table 3-1. Melton classification of denominational families

A second form of classification, rather than viewing denominational differences, investigates aspects of Christian theology and doctrinal themes. DeLashmutt and McCallum (*s.d.*)[x] identify and define sects by doctrinal positions on bibliology, Christology, soteriology and eschatology. Sawyer (1999) provides comprehensive and extensive taxonomic charts ranging from aspects of church history through to all branches of dogmatic theology[11]. Rigorous structure has also been applied in the Zondervan press series (Bowman, 1995; Rhodes, 1995; Beisner, 1998) highlighting

[10] Although meltons naming scheme was not adopted, families were included or omitted from the study (Table 3-1) for reasons provided (§3.3.2).

[11] Unfortunately, the method had been applied by the time I obtained this book. However, chosen traits matched Sawyer's taxonomy. Again, providing a definitive reconstruction was not the purpose of the current exercise although it will be suggested in part 4.

the features and, according to the authors, doctrinal flaws of cults and religious movements.

3.3.3.3 Scientific & memetic perspectives on religion

Religion, especially that of Abrahamic lineage, seems to hold a particular fascination for writers on memetics. Faith and scripture, they would argue, are the antithesis of science yet persist and spread by virtue of this property. The memetic perspective might suggest that religious faith is a particularly well adapted mind virus that while immunising its host against competing memes, also induces its host to proselytise (Brodie, 1996; Dawkins, 1993; Lynch, 1996; Fog, 1996). A fuller memetic appraisal of religion is given in appendix L.

Judging from the focus of much memetic thought, it would appear that Christian faith is becoming the memetic equivalent of *Drosophila melanogaster* as, from a secular perspective, *a religion is nothing more than a way of spreading a religion.* Religion then is the least contaminated exemplar of a purely memetic strain. In order to minimise extraneous influences when testing the methodology, this research follows the tradition of examining religious memes. Hopefully this may also contribute to the development of a scientific baseline for future research. To reiterate however, the present research simply takes western Christianity as a suitable test case for evaluating the methodological hypothesis.

3.3.3.4 Religion specific considerations

In order to apply the methodology specifically for the religious test group certain additional assumptions are needed.

3.3.3.4.1 Religious "species" as Operational Taxonomic Unit

Along with the criteria for inclusion provided in a previous section (§3.3) consideration has to be given as to what constitutes a religious operational taxonomic unit – that is, what constitutes an organisational *specie* (McKelvey, 1978) as opposed to an individual, genus or other taxonomic rank. Further to the abiotic ranking suggestion (§1.1.5) and in line with *Adherents* taxonomic ranking system (§3.3.3.2) a suggested parallel with zoological ranking is made (Table 3-2).

Zoological Rank	*Faith Group Rank*	*Prior Example*
Order	Religion	Christian
Family	Branch	Protestant
Genus	Denominational Family	Presbyterian
Specie	Religious Body	The Presbyterian Church (U.S.A.)
Individual	Congregation	Oak view Presbyterian Church

Table 3-2. Zoological and Faith Group rankings compared

The associations between order and family (and possibly higher) are somewhat arbitrary. The relationship between the lower 3 rankings does however fit conveniently in with the zoological system to some extent[12]. The differences between *congregations* are (mainly) with geographical region and the people involved. Actual belief/ritual (etc.) content between congregations are much the same across the *religious body* (otherwise known a denomination) there is no essential disagreement. For this reason, congregations are associated with the individual. Between *religious bodies*, at the "specie" level, there exist sufficient differences to merit at least some minor distinction in doctrine or practice that "forces" separation. Despite these differences the religious bodies recognise themselves as being of the same *denominational family* or "genus". Interestingly, a religious body's choice of name often reflects the wider denominational family (for example within Methodism (§3.4.3.2.4) and in this way, parallels the Linnaean binomial system.

The concept of religious body adequately reflects that of species, being the lowest rank of discernable difference. Additionally *Adherents.com* states:

> A **religious body** is an identifiable religious body which is the primary focus of membership and religious activity. Religious bodies are often incorporated or otherwise officially registered with governmental bodies. A religious body typically has a membership roster. In government publications, religious/church "affiliation" often refers to officially belonging to a religious body (or a congregation, which in turn is part of a religious body or organization). They often have their own periodicals and publications. A religious body has an administration and organization unique to itself, responsible for governing or serving or answering to (as the case may be) only its members.

This then is to be taken as the level of OTU and it is speculated that this is the level at which evolution is occurring. Exceptions to this are where a movement, parachurch or other sociological phenomena are deemed significant enough for inclusion as an OTU.

[12] The biological ranking of that those words "body" and "family" are to be dissociated from conventional uses.

3.3.3.4.2 Time frame of study

In order to keep the phenetic analysis as a snapshot in time, sects and denominations were taken as their most current form. It is clear that some of the older (e.g. the Church of England (ACC)) and even some recent bodies are significantly different now than their original form, as they have altered their stances on various issues. Where this has occurred, it is taken that the original form was different but used the same vernacular name. The most recent discernable form is taken as representative and the Church of England refers to its state at time of investigation at the turn of the 21st as opposed to in the 16th century. In defunct forms, such as the Branch Dravidians information is accessed from where and when available.

3.3.3.5 Expected observations for validating hypothesis

The first three methodological criteria, stated in §2.4.2.3, are secured; faith groups have been selected as their sufficient historical records (§3.3.1.1) enable the direct genealogical reconstruction of a phylogram, while distinguishable characteristics among religious bodies (§3.3.1.2) enable the construction of a phenogram. Evaluation of the methodological hypothesis is therefore contingent upon the final criterion of matching the independently constructed phenogram and phylogram. In this research, only the positive case among faith groups was, to some extent demonstrated, owing to the constraints covered in §2.4.2.6.

The outcome matrix (§2.4.2.4) implies that, in the presence of a non-genetic replicator (religion as meme), faith groups related by common ancestry are likely to bear resemblances. Hence, according to the methodological hypothesis congruence between phylogram and phenogram would support a case for organisational phylogeny and the possibility of a memetic methodology; no discernable match would be consistent with decent without inheritance.

However, as the outcome matrix highlights potential difficulties (§2.4.2.4.1): a false positive may arise through poor data or coincidence; a false negative through, muddled lineages, low replicator fidelity, or there is an error in the method that has not be detected.

The similarity between trees is also subject to methodological assumptions (i.e. selection of Hamming and UPGMA strategies) and limits of manual comparison as well as extraneous factors upon historical accuracy. It is neither expected nor necessary that the dendrograms should exhibit an exact match but in the absence of an established tree comparison metric a general resemblance will have to suffice.

3.3.3.6 Expected auxiliary observations

There were other expected observations arising from the study that, while not directly contributing to the methodological hypothesis, were nevertheless interesting from a memetic perspective. Appendix M presents the results for discursive reasons.

3.4 Method application to religious bodies

With the selected test group of religious bodies, taking into account specific methodological considerations and expectations, the method can now be applied.

3.4.1 Review of method structure

The structure of the method is exactly that described previously (§2.5.1.1) and is depicted in figure 3-2.

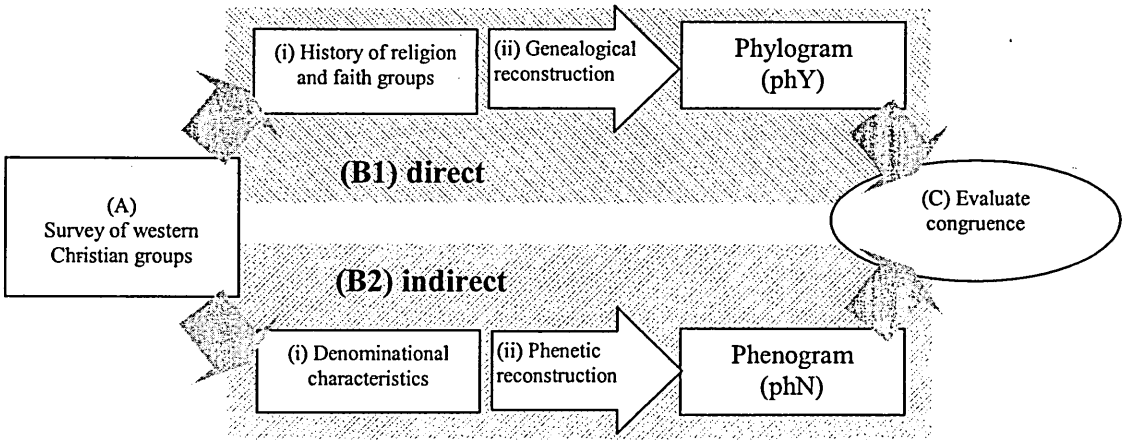
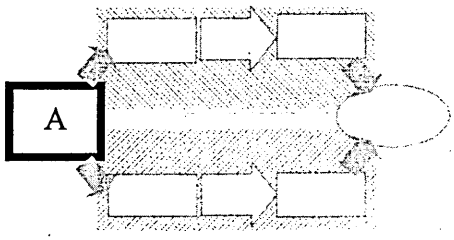


Figure 3-2. Method applied to religious bodies

3.4.2 Common information gathering (A)

A survey of the sources of information about religious bodies was conducted and those OTUs for inclusion in the study were selected and given unique identification.



3.4.2.1 Sector survey (A-i)

The World Wide Web is a valuable and accessible source of information of varying quality on religious forms. This is the case for religion as proponents, antagonists and observers of any religious inclination have the uncensored opportunity to air their views.

The purpose of the search was to examine the scope of what religious organisations were available for study and any typologies available; search criteria were created to find web pages that listed religions with the hope that they would provide further

hyperlinks. There were a variety of sources and the information they linked to depended upon the nature and agenda of the interest group in question. The following are representative of the sources accessed as lists and links on the net.

3.4.2.1.1 Counter-cult

These are groups with Christian beliefs and aim to counter NRMs but do not provide much in terms of mainstream Christianity. The Watchman Fellowship[xi] has a large (1200) list of groups and provides advice in terms of witnessing tips to counter such as the Jehovah's Witnesses and the Mormons

> Watchman Fellowship is an independent Christian research and apologetics ministry focusing on new religious movements, cults, the occult and the New Age. We serve the Christian and secular community as a resource for cult education, counselling, and non-coercive intervention.
>
> Watchman Fellowship began in 1979 and now has representatives in several states. We have served almost every denomination including Baptist, Presbyterian, Methodist, Episcopal, Assemblies of God, Church of God, Lutheran, Nazarene, etc., as well as schools, law enforcement agencies and civic groups

3.4.2.1.2 Anti-cult

Ontario consultants for religious tolerance[xii] rather than being strictly anti-cult positions itself as promoting tolerance towards all forms of faith as a civil rights issue.

3.4.2.1.3 Atheological

Anti-Christian though biased (away from Christianity) WCS[xiii] does provide an alternative perspective on characteristics of Christianity.

3.4.2.1.4 Academic/non-denominational

These are more objective surveys of the world's religions and are not associated with any particular belief. Unfortunately Mike's religion page, a very comprehensive classifying page that was used to compile the original list of candidates is no longer available on the net others, however were also used as reference. Two pages already mentioned are: *Adherents.com* and *the religious movements page.*

3.4.2.1.5 Church Links Pages

These typically are central repositories of denominational families that are in communion and provide links to denominational or congregational home pages. E.g.

faithfinders.com[xiv] is a search engine that locates congregations not only by denomination and location but also by congregation size, ethnic composition, type of music and pastors age!

3.4.2.1.6 Home Pages

This was by far the most excessive result as many individual congregations or churches (or parochial groupings) had their own home page. Smaller groups tended to have little value in that they only listed service times, the pastor's name and their location. More useful were the homepages (official or otherwise) at the level of *religious body*, such as that of the Southern Baptist Convention[xv] that provided clear histories along with articles of faith and position on various issues.

3.4.2.2 OTU identification (A-ii)

From the sources a long list of candidate taxa were identified and from these a short list, constituting the actual OTUs was selected. This list did not have to be complete (owing to the focus and limits of the investigation) but rather representative of western Christian faith.

Both genealogical and phenetic analysis		Genealogical analysis only	
RC	Roman Catholic	**(M)MNC**	The Methodist New Connexion
ACC	Anglican Catholic Church	**(M)PMC**	The Primitive Methodist Connexion
L	Lutheran	**(M)WMC**	The Wesleyan Methodist Connexion
Calv	Calvinist	**(M)BC**	Bible Christians
R	Reformed	**(M)UMFC**	United Methodist Free Churches
P	Presbyterian	**(M)UMC**	United Methodist Churches
(M)IM	Independent Methodists		
(M)WRU	Wesleyan Reform Union		
M	The Methodist Church	**(JW)BSF**	Bible Student's Fellowship
SA	Salvation Army	**(JW)BWP**	Bible Way Publications
Q	The Society of Friends	**(JW)ChBS**	Chicago Bible Students
C	Congregationalist	**(JW)FWBS**	Fort Worth Bible Students
GB	General Baptist	**(JW)PhBS**	Phoenixville Bible Students
PB	Particular Baptist	**(JW)PoBS**	Portland Bible Students
SBC	Southern Baptist Convention	**(JW)SeBS**	Seattle Bible Students
A	Adventist	**(JW)WaBS**	Warren Bible Students
JW	Jehovah's Witnesses	**(JW)CMF**	Christian Millennial Fellowship
SDA	Seventh Day Adventist	**(JW)CRM**	Christian Renewal Ministry
DSDAA	Davidian Seventh Day Adventist Association	**(JW)COG**	Church of God, Faith of Abraham
BD	Branch Davidians	**(JW)DBSA**	Dawn Bible Students Assn
CG7	Church of God Seventh Day	**(JW)ES**	Eagle Society
WCG	Worldwide Church of God	**(JW)HKM**	Hirsho-Kittenger Movement
COZ	City of Zion	**(JW)LHMM**	Layman's Home Missionary Movement
CP	Classical Pentecostalism	**(JW)OM**	Olson Movement
AG	Assemblies of God	**(JW)PBIB**	Pastoral Bible Institute of Brooklyn
BR	Brownsville Revival	**(JW)RM**	Ritchie Movement
UPC	United Pentecostal Church	**(JW)StaM**	Standfast Movement
ICFG	Int. Church of the Foursquare Gospel	**(JW)StuM**	Sturgeon Movement
CC	Calvary Chapel		

Table 3-3. Religious bodies as OTUs

In reality the process progressed iteratively whereby while other sections of the method were being conducted the discovery of a new possible denomination allowed decisions to be made as to its inclusion in the OTU set. Further, discovery of a denomination that had been erroneously included as an OTU allowed it to be eliminated.

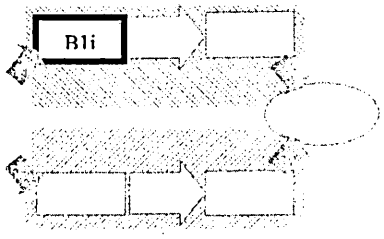
The official (or most appropriate) name of the each religious body was established from the literature (particularly homepages) and each was assigned an arbitrary numerical ID along with an acronym reflecting the name. This was to assist with visual interpretation of the results as many of the names (such as "International Church of the Foursquare Gospel") were unwieldy.

The final selection of operational taxonomic units for construction of direct genealogical and indirect phenetic phylogeny are shown in table 3-3, those in the right hand column are a list of OTUs that were included in the direct phylogeny but not in the phenetic analysis owing to limitations in the ability to characterise defunct or minor bodies – (JW) and (M) prefixes denote that they are of the Jehovah's Witness or Methodist family respectively.

Certain unusual elements were included such as Calvinist, Adventist and City of Zion as, although these were not in themselves denominations, they lead to the formation of denominations and offer potential splitting points in lineage.

3.4.3 Direct genealogical reconstruction (B1)

The direct ancestor for each of the selected religious bodies in the study were identified allowing direct phylogram of Christian patterns of descent to be reconstructed.

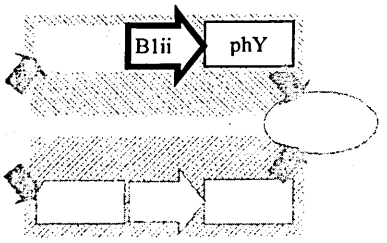


3.4.3.1 Historical data gathering (B1-i)

More in depth information was gathered (from previously cited sources) about the selected bodies with the focus of trying to find the parent body. Particularly valuable was the religious movements page, as University of Virginia sociology students had compiled most of the requisite information about chosen denominations. Homepages

featuring history along with Christian history pages assisted in verification of data. While dates, founders and circumstances surrounding the formation of a body were not directly relevant, these helped to establish parent-child denominational relations. The information is broken down here into the major groupings and refined as necessary into denominational families. Much of the intermediate and extinct forms are not included in the final analysis.

3.4.3.2 Genealogical reconstruction (B1-ii)



Individual sections of the tree will be constructed and examined here in terms of the broad groupings. Where possible, the trees are compared with those presented by other authors. These are then built into an overall picture of western Christian phylogeny. Appendix G presents a composite tree.

3.4.3.2.1 Early splits

While pre-reformation schism is not the target of this research, it is worthwhile acknowledging the split between the western liturgical tradition and eastern branches, such as Coptic Jacobite and Eastern Orthodox in order to appreciate the bigger picture of the phylogeny. Mather and Nichols (1993) note how Christological heresies of the early church lead to schism and meetings of various ecumenical councils that consolidated the creeds.

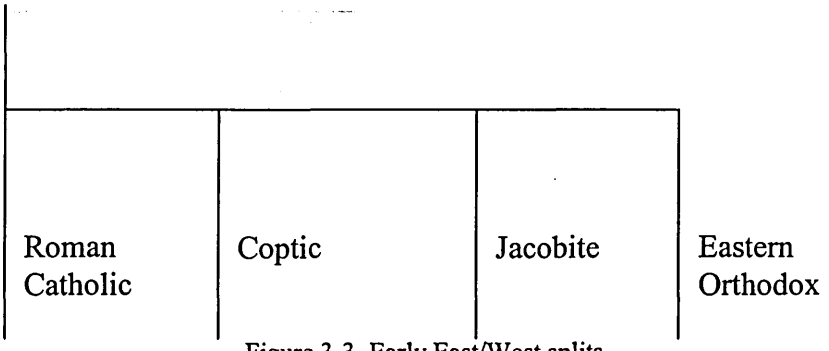


Figure 3-3. Early East/West splits

3.4.3.2.2 Reformation

The reformation was instigated by Luther's protest at the sale of indulgencies and the nailing on October 31st 1517 of 95 theses to the door of Wittenberg Cathedral. Which eventually became the basis for the Lutheran Church. Later, Henry VIII, deciding that he did not require the bishop of Rome's permission to have his marriage annulled, declared himself head of the English church (Anglican Catholic Church). From the ACC came Congregationalist, General Baptist (GB), the Society of Friends or Quakers, (Robberts, 1999) and Methodism (detailed in §3.4.3.2.4).

Another major split from the Roman Catholic Church came from John Calvin's theology (detailed in §3.4.3.2.3). The three main splits from RC are shown in figure 3-4 along with the sub-schisms of the ACC.

Roman Catholic	**RC**		Peter	1054
Lutheran	**L**	RC	Martin Luther	1517
Anglican Catholic	**ACC**	RC	Henry VIII	1529
Calvinist	**Calv**	RC	John Calvin	1536
Congregationalist	**C**	ACC	Robert Brown	1581
General Baptist	**GB**	ACC	John Smyth and Thomas Helwys	1608
The Society of Friends	**Q**	ACC	George Fox	1650
The Wesleyan Methodist Connexion*	**(M)WMC**	ACC	John Wesley	1795

Table 3-4. Reformation splits

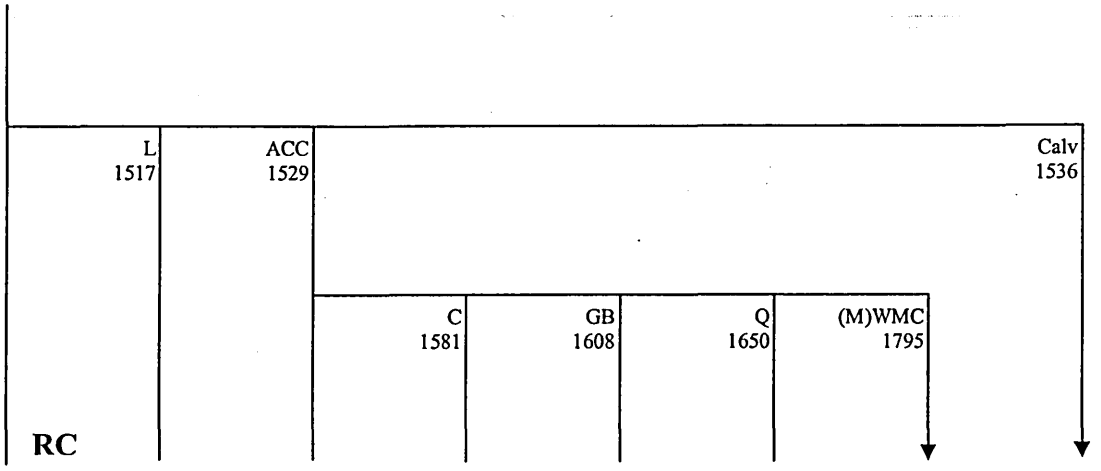


Figure 3-4. Sub phylogram of reformation

3.4.3.2.3 Calvinist

Calvinism is the protestant theology of John Calvin that consists of five points summarised by the acronym TULIP[13] – though beyond the scope of the present report Calvinism is characterised by limited (or particular) as opposed to general atonement. While Calvinism itself is a theology and not a denomination, it is included as it had significant influence on the formation of many religious bodies such as the Reformed, Presbyterian and Particular Baptists groups. It is the issue of atonement (stemming from lineage) that differentiates the General from the Particular Baptists.

The particular Baptists were subject to influencing the formation of groups also. The prominent one is the Southern Baptist Convention owing to number of adherents and conversions. Both the Adventist movement (detailed in §3.4.3.2.5) and the City of Zion (Pentecostal in §3.4.3.2.7) influence other bodies yet both are defunct.

Roman Catholic	**RC**		Peter	1054
Calvinist	**Calv**	RC	John Calvin	1536
Reformed	**R**	Calv		
Presbyterian	**P**	Calv		
Particuar Baptist	**PB**	Calv		1633
Southern Baptist Convention	**SBC**	PB		1845
Adventist	**A**	PB	William Miller	1836
City of Zion	**COZ**	PB	John Alexander Dowie	1900

Table 3-5. Calvinist

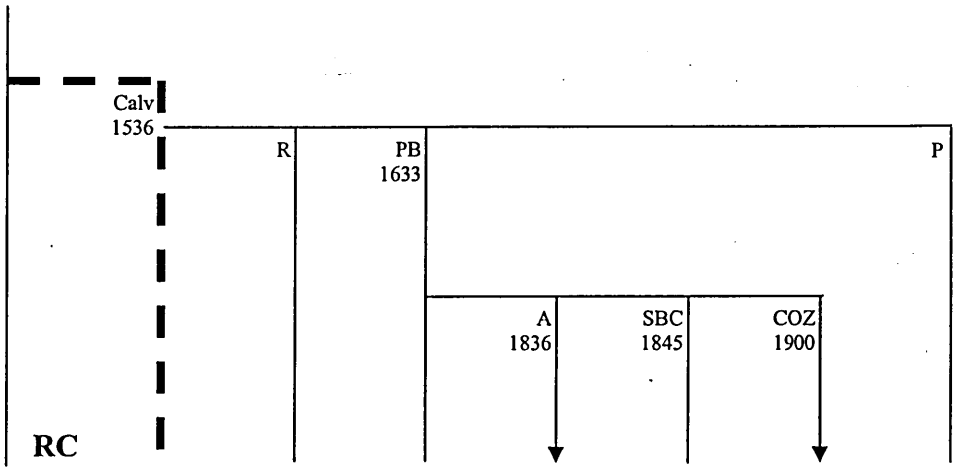


Figure 3-5. Sub phenogram of reformation

[13] TULIP is the acronym for: Total Depravity (also known as Total Inability and Original Sin), Unconditional Election, Limited Atonement (also known as Particular Atonement), Irresistible Grace, Perseverance of the Saints (also known as Once Saved Always Saved)
http://www.mslick.com/tulip.htm

3.4.3.2.4 Methodist

Methodism began as a society within the Church of England by John & Charles Wesley. Methodism became popular as Wesley travelled England extensively and was able to reach the under classes during early industrialisation (Bates, 1977, Davies, 1976, Thompson 1985, Fairbank, 1983).

Anglican Catholic	**ACC**	RC	Henry VIII	1529
The Wesleyan Methodist Connexion*	**(M)WMC**	ACC	John Wesley	1795
Independent Methodists	**(M)IM**	(M)WMC		1796
The Methodist New Connexion*	**(M)MNC**	(M)WMC	Alexander Kilham	1797
The Primitive Methodist Connexion*	**(M)PMC**	(M)WMC	Hugh Bourne & William Cloes	1811
Bible Christians*	**(M)BC**	(M)WMC	William O'Bryan (Billy Bray)	1815
United Methodist Free Churches*	**(M)UMFC**	(M)WMC		1857
Wesleyan Reform Union	**(M)WRU**	(M)WMC		1859
Salvation Army	**SA**	(M)MNC	William Booth	1861
United Methodist Churches*	**(M)UMC**	(M)MNC/BC/UMFC	join	1907
The Methodist Church	**M**	(M)WMC/UMC/PMC	join	1932

Table 3-6. Methodist

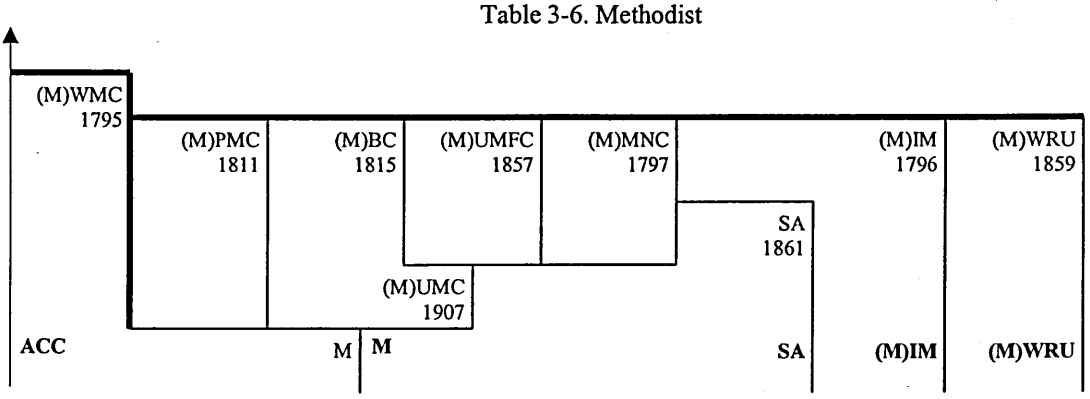


Figure 3-6a. Methodism

As there is reconciliation within the Methodist pattern then it can be seen that on more than one occasion *varieties* merge into a single form. These intermediate and temporary forms allow for reduction into a true tree structure of extant bodies (Fig 3-6b).

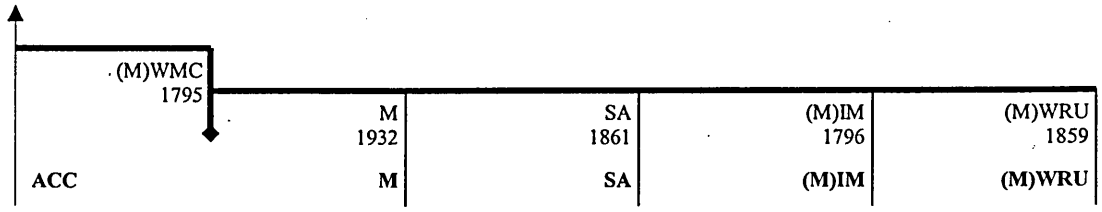


Figure 3-6b. Methodism (compacted)

3.4.3.2.5 Adventist

The Adventist group originates from the Millerites, followers of William Miller's eschatological forebodings. After the "great disappointment", when the prophesies failed the Millerites disbanded and various stragglers consolidated into the Seventh Day Adventists (who worshiped on Saturday). A division of the SDA is the Church of God Seventh Day and a further subdivision of the Worldwide Church of God. (Puckett, *s. d.*; Tucker, 1989; Linden, 1978; Mather & Nichols, 1993)

Importantly, the SDA have a second split, the Davidian Seventh Day Adventist Association that, following internal power struggles precipitated the cultish Branch Davidians who were famously caught in the siege at Waco in 1993 (Moran, 1999).

The Jehovah's Witnesses also originated within the Millerite movement (detailed in §3.4.3.2.6)

Particular Baptist	**PB**	Calv		1633
Adventist (Millerite)*	**A**	PB	William Miller	1836
Seventh Day Adventist	**SDA**	A	Ellen White (et. Al)	1863
Davidian Seventh Day Adventist Association*	**DSDAA**	SDA	Victor Tasho Houteff	1929
Branch Davidians*	**BD**	DSDAA	Ben Roden	1965
Church of God Seventh Day	**CG7**	SDA	G. C. Rupert	1884
Worldwide Church of God	**WCG**	CG7	Herbert W Armstrong	1934

Table 3-7. Adventism

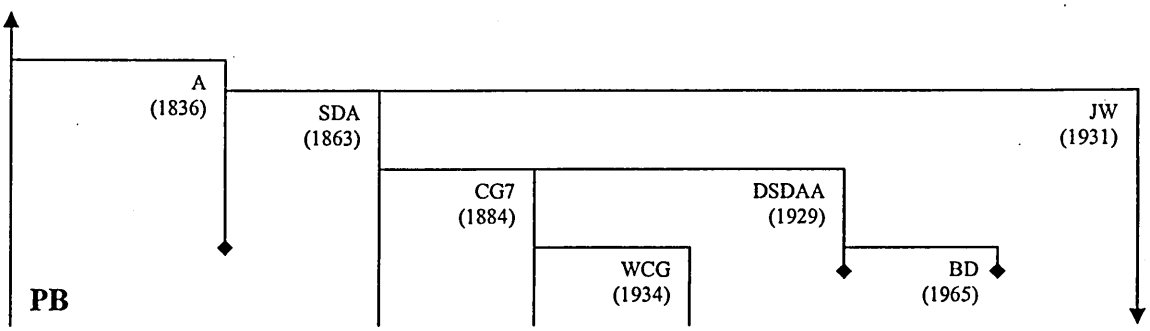


Figure 3-7. Adventism

3.4.3.2.6 Jehovah's witnesses

The Jehovah's Witnesses also arose from the Adventist (Millerite) movement and are notoriously prosalytic in their approach (Bowman, 1995; Berry, 1987; Tucker, 1989). Watters (1991) argues that the JW's claim (Watchtower, Nov 1991) to be 'Fitly united in the same mind' is somewhat challenged by the number of movements that stem from it (Table 3-8). The fate of JW subgroups is currently unknown.

Adventist	**A**	PB	William Miller	1836
Jehovah's Witnesses	**JW**	A	Charles Taze Russel	1931
Bible Student's Fellowship	**(JW)BSF**	JW		
Bible Way Publications	**(JW)BWP**	JW		
Chicago Bible Students	**(JW)ChBS**	JW		
Fort Worth Bible Students	**(JW)FWBS**	(JW)ChBS		
Phoenixville Bible Students	**(JW)PhBS**	(JW)ChBS		
Portland Bible Students	**(JW)PoBS**	(JW)ChBS		
Seattle Bible Students	**(JW)SeBS**	(JW)ChBS		
Warren Bible Students	**(JW)WaBS**	(JW)ChBS		
Christian Millennial Fellowship	**(JW)CMF**	JW		
Christian Renewal Ministry	**(JW)CRM**	JW		
Church of God, Faith of Abraham	**(JW)COG**	JW		
Dawn Bible Students Assn	**(JW)DBSA**	JW		
Eagle Society	**(JW)ES**	JW		
Hirsho-Kittenger Movement	**(JW)HKM**	JW		
Layman's Home Missionary Movement	**(JW)LHMM**	JW		
Olson Movement	**(JW)OM**	JW		
Pastoral Bible Institute of Brooklyn	**(JW)PBIB**	JW		
Ritchie Movement	**(JW)RM**	JW		
Standfast Movement	**(JW)StaM**	JW		
Sturgeon Movement	**(JW)StuM**	JW		

Table 3-8. Jehovah's Witnesses

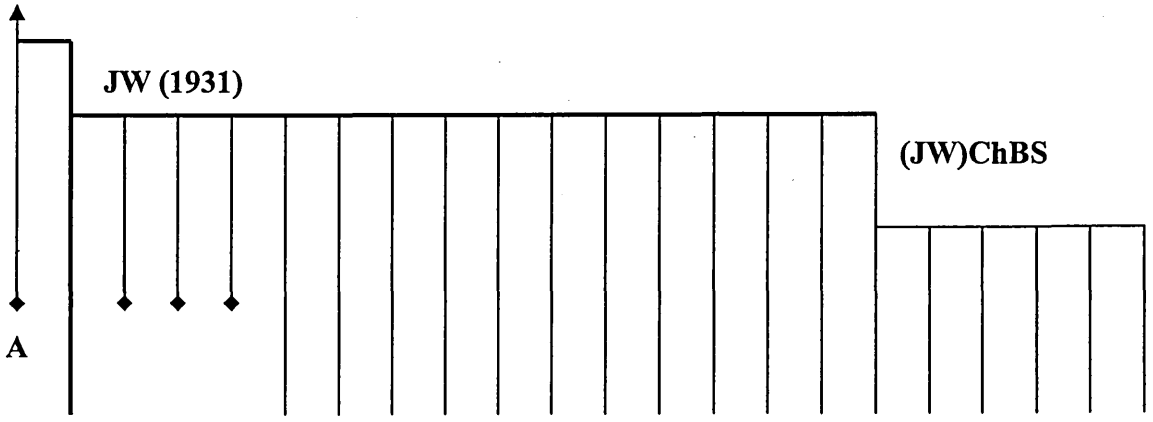


Figure 3-8. Jehovah's witnesses

3.4.3.2.7 Pentecostal

Faith healer, John Dowie founded the City of Zion community, Illinois, from which many of the Pentecostals arose. At 312 Azousa St. Parham and Seymour began a revival based around the concept of glossolalia (Speaking in tongues). Like the Methodists, 20th century Pentecostal movements have seen much splitting and merger – however these have had the basis in racial tension (Beisner, 1998; Burgess and McGee). Note that PAW(3) and ICFG were not included in the phenetic iteration.

Particular Baptist	**PB**	Calv		1633
City of Zion*	**COZ**	PB	John Alexander Dowie	1900
Classical Pentecostalism	**CP**	COZ	C F Parham & W J Seymour	1901
Pentecostal Assemblies Of The World*	**PAW(1)**	CP		1906
Assemblies of God	**AG**	CP	Eudorus N Bell	1914
Brownsville Revival	**BR**	AG	EC Ward	1995
International Church of the Foursquare Gospel	**ICFG**	CP	Aimee Semple McPherson	1923
Calvary Chapel	**CC**	ICFG (AG)	Chuck Smith	1965
General Assembly of Apostolic Assemblies*	**GAAA**	AG	Gross, Rodgers, Opperman	1916
Pentecostal Assemblies Of The World*	**PAW(2)**	PAW(1)+GAAA		1918
Pentecostal Church Incorporated*	**PCI (1932)**	PAW(2) (PMA '25)		1925
Apostolic Church of Jesus Christ	**ACJC**	PAW(2) (ECJC '21)		1927
Pentecostal Church of Jesus Christ	**PCJC**	ACJC+PAW(2)		1931
Pentecostal Assemblies Of The World*	**PAW(3)**	PCJC	Samuel Grimes	1937
United Pentecostal Church	**UPC**	PCI+PCJC	[Harry Branding, Oliver F. Fauss	1945

Table 3-9. Pentecostal

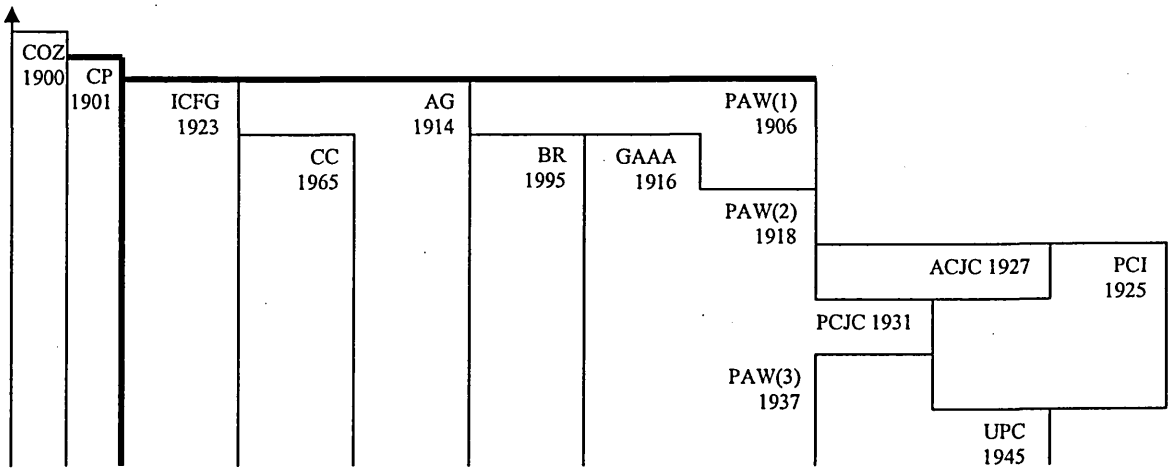


Figure 3-9. Pentecostal

3.4.3.2.8 Summary

The individual trees can now be amalgamated into a single phylogram such that it can be compared with the phenogram. In practice the final tree was generated though use of an auxiliary function of MENDEL. The result is shown in Appendix G. The general pattern of the genealogical phylogeny however can be abstracted as the main groupings that they form. In line with the categories above and with Melton's classification system, these groupings are at the level of denominational family and may variously be called:

- *Episcopalian*, which included Lutheran, Anglican and sub-branches;
- *Reformed* which includes Calvinists and Particular Baptists,
- *Adventist* arising from the Millerite movement and
- *Pentecostal.*
- *Roman Catholicism* is considered a grouping on its own.

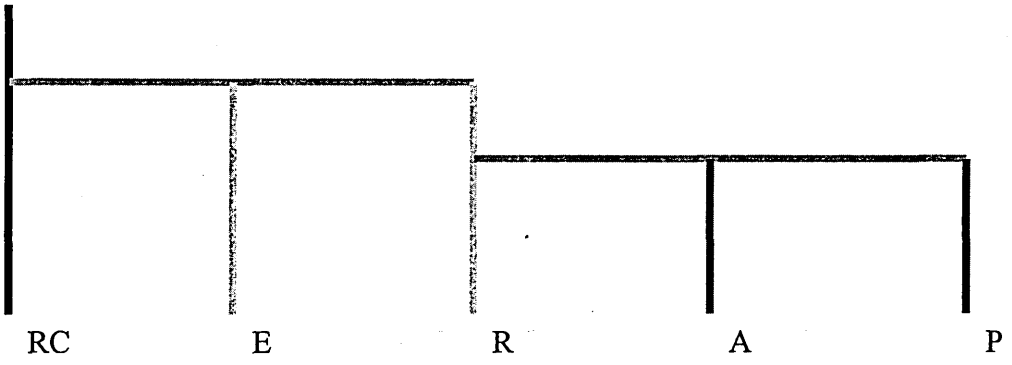


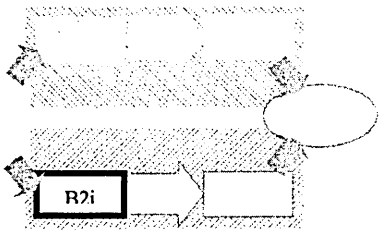
Figure 3-10: abstracted genealogical phylogeny

3.4.4 Indirect phylogeny reconstruction (B2)

A set of characters now needs to be chosen for the religious bodies (OTUs) identified §3.4.2.2. The state of each character then needs to be determined for each taxon allowing phenetic analysis thereby revealing the pattern of doctrinal and structural resemblance between denominations.

3.4.4.1 TCM assignment -meme mapping (B2-i)

The meme mapping technique described in §2.5.4.1 can be applied to religious denominations in order to produce a set of putative meme strips.



3.4.4.1.1 Criteria for character choices

A series of characters, from which states are to be determined, needs to be chosen and the criteria for their choice (in the denominational domain) needs to be laid forth. This list does not have to be definitive or complete (owing to the methodological focus of the investigation) but rather representative and one that assists evaluation of the hypothesis.

It has been assumed that a religious body is an organisation that consists of congregations of people who, to a large extent, share a common set of beliefs. These beliefs consist of theological concepts (what to think) as well as those concerning how to be organised (what to do). Hence two main groupings consist of organisational *structure* and theological *belief*. Characters were required in both types.

As noted, the characterisation of organisations is subjective, religious organisations even more so. The use of secondary data was proposed as a means to enhance objectivity. In the application of the method, characters were derived from the narrative of comparative religions presented by other authors.

One criterion used was the Gross availability of a character. If a character were blatantly stated as appertaining to many denominations then it would be a prime candidate for inclusion. Another clear indicator was where a comparison of two denominations stated the difference between them.

3.4.4.1.2 Definitions of characters

The table 3-10 provides a list of characters, which are defined in greater detail in Appendix E

Group	Class	Character
Structure	Type	Extant, Incorporated, movement, theology
	Leadership/Polity	Hierarchical, Episcopalian, Presbyterian, Congregational, Autonomy, Charismatic Leadership, Papal Authority, Prophet Founder, Women ministers
	Life	Excommunication, Lifestyle, Proselytic, Exclusivist
Belief	Godhead	Unitarian, Trinitarian, Infinitarian
	Christology	Son, Arian, Monophysitism, Modalistic Monarchianism
	Soteriology	Predestination, General Atonement, Particular Atonement, Solifidianism, Faith &Works
	Eschatology	Amillennialism, Postmillennialism, Dispensational Premillennialism, Date Setting
	Hermeneutics	Fundamentalist
	Sabbath	Sunday, Saturday
	Sacrementology	Baptism, Paedobaptism, Belief, Total Immersion, Jesus only Formula, Spirit Baptism, Holy Eucharist, Confirmation, Penance, Orders, Matrimony, Extreme Unction
	Peculiarities	Soul Sleep, Annihilation, Investigative Judgement

Table 3-10. Character list by classification

3.4.4.1.3 Data collection

For each denomination, the state of its characters needed to be established. Secondary data was rarely tabulated or given any convenient form of organisation on the grounds that narrative was aimed at the author's intentions. Actually determining a state mainly required understanding the meaning of that state and interpreting the provided narrative in the light of this understanding.

One particular difficulty with many religious concepts is that they are metaphysical which, by their very definition, are non-measurable. Within the neo-positivist epistemology and focus of the research however, questions about the content of mysteries such as *transubstasiation*[14] are not only meaningless but also irrelevant. Christianity states only believers can appreciate such mysteries (so believing is seeing). Another major difficulty in establishing the meaning of some belief systems was in that many theological explanations were based on biblical reference or required an understanding of yet deeper and more abstract metaphysical concepts. It was not the researcher's original intention to devote the time required to become

[14] The conversion of the whole substance of the bread and of the wine in the Eucharist into the whole substance of the body and blood of Christ respectively. (Mascall: Dictionary of Christian Theology)

familiar with these theological concepts but it became necessary to do so determine states from the available data.

Levels of confidence ranged from where the presence or absence of a character was explicitly stated, such as in a creed, through to where it could be inferred by reading between the lines of multiple data sources.

Where it was clear, from the data that a character applied to a denominational family, then, unless otherwise stated, it was applied to all the denominations within that family.

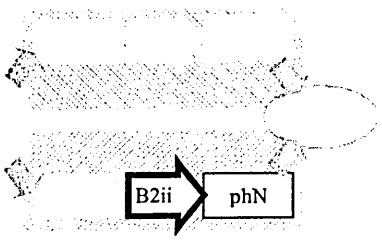
Construction of the *taxa character matrix* (Appendix C) proceeded iteratively whereby states where found and where characters became redundant or new characters came to light, then these were deleted or added as appropriate. The result was a taxa character matrix consisting of meme maps for each denomination.

3.4.4.1.4 Data entry

In order to allow MENDEL to perform its analysis, the collected data needed to be entered into a computer in a compatible format. Entry of the character states was greatly facilitated by use of the Microsoft Excel interface. The names of the religious bodies were placed in a column while character names were placed in a row in order to form a table. The intersections constituted the character states in which the values of 0 or 1 could be placed. The size of the table and the erratic availability of each datum required that colour coding the table such that missing data was highlighted enabled searches for specific data. Furthermore, a percentage of found data could be displayed at any time. Data could be moved around easily in the spreadsheet thus enabling various characters and taxa to be included in the analysis. The resultant data table is depicted in Appendix F.

3.4.4.2 Phenetic reconstruction (B2-ii)

Hamming distance was used as a modified association coefficient and UPGMA was chosen as the clustering algorithm (as discussed in part 3). The results were plotted

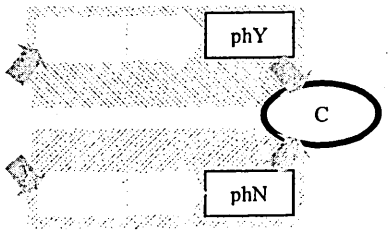


out on an Excel spreadsheet whereby they could be copied and pasted into other applications.

Although processing of the data to form a phenogram was required only for the full set of data, the actual task was conducted numerous times (as data became available). For this reason, an additional feature was implemented whereby the Excel Spreadsheet range of the taxa character matrix was placed in cell "A1" along with a button to activate MENDEL on the sheet where the phenogram was to be plotted. Parameters were set such that the resultant dendrogram produced a horizontal plot featuring acronyms of religious bodies and taxonomic distances. Owing to current limitations of the software, further analysis had to be performed by manual coloration of lines in a vector based graphics application (Corel Draw 9).

Because UPGMA was the chosen clustering algorithm then this did not directly support weighting. Experimental weighting was, however desirable for example in the case of examining the power of the episcopate and sacraments in preserving the *memeplex*. Simulating higher weighting was achieved through copying and pasting a character column (integer weightings only) while moving a column out of range effectively removed a character from the analysis. The resulting phenograms are depicted in Appendix G.

3.4.5 Evaluate Congruence (C)



Two dendrograms now existed which needed to be compared in order to establish the degree of congruence and support of the hypothesis. This was done using the manual colouring method and "phenon abstraction" method (§2.5.5.3). Though early results were promising, there were discrepancies at both the "macro" and "macro" level; the "meso" level provided the better match. Other iterations of comparison were performed using different starting parameter values. These are described in the next section.

3.5 Results

Expectations have been stated as the test of congruence (§3.3.3.5); the main results diagrams are in appendix G while auxiliary observations are in appendix M.

3.5.1 Comparison between dendrograms

The phylogram and the phenogram were compared using the suggested method (§2.5.5). Again, in the absence of any established metric of congruence between dendrograms, a judgemental approach was taken by the researcher (Lord & Price, 2001). Ideally, there would be an exact match which would show that traits follow patterns of descent; this ideal is frustrated on the grounds that the phylogram and phenogram, although dendrograms, are different structures representing different information. Despite this distinction, a match would be clearly discernable.

It was thought that the trees would be comparable as a whole structure, however because of the clustering, it became apparent that comparison was to be stratified into various levels: The micro level was concerned with the interrelationship and comparison between religious bodies within clusters (e.g. fig. 3-13). The macro level was concerned with the interrelationship and comparison between clusters of religious body (e.g. fig. 3-11).

It soon became apparent that a third level of comparison, mezzo level was needed. This was of a higher order as it compared the *relationship* between a taxon and its group between the two dendrograms.

Immediately apparent in both trees is that there are four common abstract groupings (the macro level) of religious body that roughly corresponded to *denominational families*: Episcopal, Reformed, Adventist and Pentecostal. The *religious bodies* of Roman Catholic, Millerite Adventist, and the Quakers, float outside the main groupings (fig. 3-11). The macro levels of both trees can be compared and Figure 3-12 (and fig. G-5a) shows the un-weighted trial[15]: the abstracted phenogram (without

15

the floating Quaker and Adventist bodies), the phylogram along with a phenogram highlighting the Quaker and Adventist bodies.

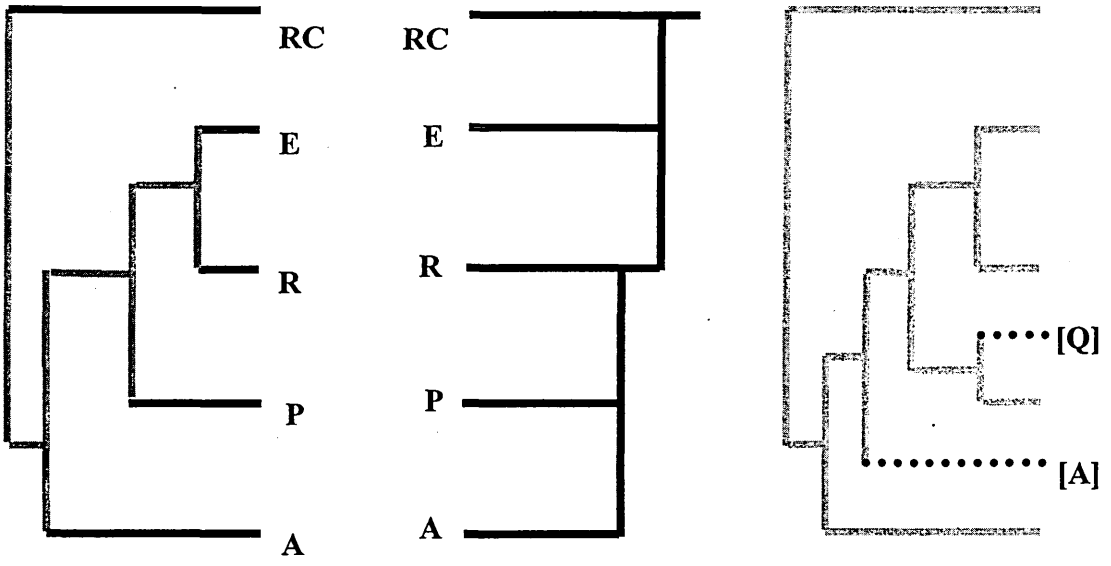


Figure 3-11. Comparison at a macro level (un-weighted trial)

At first there would appear to be an exact match (fig. 3-11) from which the following phylogenic scenario could be inferred: during the time of the reformation, two protestant families formed that were quite similar to each other. The R family subsequently sported two further families (P and A), that although more similar than the RC were less similar than E.

Unfortunately, there is a large problem: the fewer the taxa the higher combinatorial probability of a match. There is the issue of the rotational transformations available both phenograms and phylograms (see appendix A-4). Additionally the re-weighting experiments, which as appendix G shows, can also be transformed to produce a match from which plausible phylogenic scenario's can be invented. Even in the absence of a suitable comparison metric (or manually drawing out all the combinations) it is suspected that the macro level results may be slightly but not significantly better than random.

At the other end of the scale are the micro level comparisons (G-7) that can be made within the denominational families. With a couple of exceptions that will be dealt with later, there appears to be consistency in matching. In most cases transformations could be applied so as to minimise "crossing" (signifying an unexpected clustering) when comparing the trees: There was no "crossing" in the R and E groups; BR did so

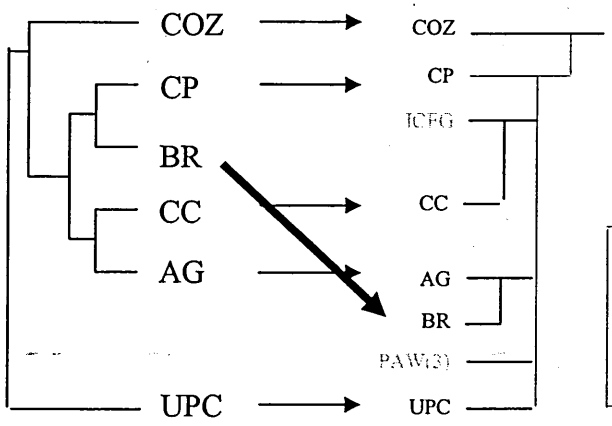


Figure 3-12a. Pentecostal comparison at micro level

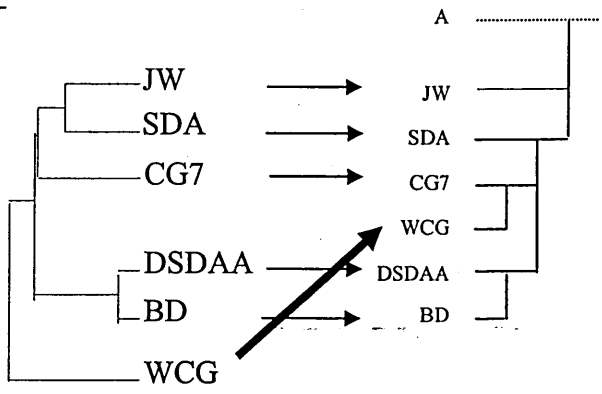


Figure 3-12b. Adventist comparison at micro level

in P when it was expected to be closer to CP (fig. 3-12a); WCG turned out to be the out-group in A when it was expected to be closer to CG7 (fig. 3-12b).

Although matching was pretty much consistent, the micro level analysis consisted of groups of between 5 and 7 bodies. Again with so few taxa then the chance of incidental matching increases; the significance of the matches are therefore unknown.

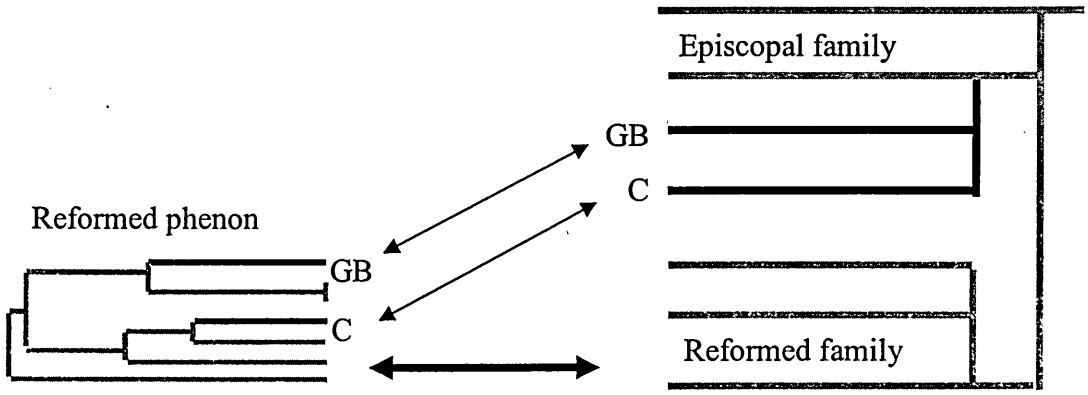


Figure 3-13 General Baptist and Congregationalist mismatch.

While both the macro and micro level are questionable, a clear and significant[16] pattern occurs between at what might be called the mezzo level. In general, where a body fell into one of the macro groups on the phylogram, it also fell into the same group in the phenogram. For example, each member of the Pentecostal group in the phylogram was a member of the Pentecostal group in the phenogram and visa versa. There were the exceptions of the General Baptists and the Congregationalists religious bodies whose lineages appear Episcopalian but seem more akin to the Reformed group (fig. 3-13).

Incidentally, experimental weighting of the B-meme only influenced the macro structure; the mezzo and micro structures were unaffected (see Appendices G & M).

3.5.2 Analysis of application to pilot group

In order that the method (devised in part two) does not remain an untested abstraction, it was sufficient and necessary to perform a single pilot study (§2.4.2.5). It has been argued that western faith groups, by offering sufficient historical records, distinguishable characteristics and wide diversity (§3.3.1), are a suitable candidate to meet the first three methodological criteria of independent synchronic and diachronic construction (§2.4.2.3). The essential issue then is the fourth criterion of a match: do the above results meet with expectations (§3.3.3.5) in accordance with the outcome matrix (§2.4.2.4).

The objective of choosing a pilot with a wide diversity was to make the apparent match or mismatch clear-cut. Comparative religion points to a vast array of faith types (Melton, 1996) and it was anticipated that even a small subset would be sufficient to make a coincidental match between iterations combinatorially improbable. The *match-absent* case would have been ruled out from the outcome matrix thereby suggesting a correlation. The match or mismatch, in the absence of a metric was to be decided visually.

[16] Again, it is difficult to put a value on how significant in the absence of a suitable metric.

3.5.2.1 The difficulty of three levels

It was anticipated that the research would produce two large trees that would more or less produce a visual match. It was not anticipated that the tree could be viewed on more than one level! Furthermore, neither of the direct comparisons (micro and macro) were decidable whereas an indirect property, on the mezzo level, did strongly suggest a pattern. In other words, deciding whether there was a match or not wasn't as straightforward as the methodology initially considered. The question of the pilot's match remains; there are three ways of tackling it.

The first solution would be to change the options chosen for the method, such as association coefficient or clustering strategy. It may or may not be that other assumptions would redistribute the clusters such that matches at the micro and macro level would become probabilistically significant. Future implementations of MENDEL were intended to explore different options for the purpose of refining the system; such a solution is impractical at this time.

The second solution would be to widen the field of study to include much more religious bodies. The rational being: either macro or micro level (or both) would contain sufficient bodies to make a match significant. However, the sheer number of additional data points would make the effort difficult, costly, and long-winded. Even with the additional bodies, there may form a higher level clustering wherein the current problem goes unresolved.

The third and most amenable solution is to attempt to make sense of the results obtained without having to do the experiment again. Part of the problem is that, although the macro and micro can be twisted to form a direct match, it is not know whether such a match has any meaning. Perhaps it is prudent to be pessimistic, ignoring those levels to concentrate on mezzo level observations.

3.5.2.2 Interpreting the mezzo level

The micro and macro level approaches attempt *direct matching*[17]. The intermediate approach, on the other hand, uses *relative matching* and compares how the bodies are related within groupings. With a few exceptions (i.e. GB & C, see fig. 3-13) a body

[17] The terms direct and relative are used here and will be investigated further in §4.2.2.4

occurred within the same group in both the phenogram and phylogram. The chance of this occurring suggests a non-random distribution and a causal relationship. It might be argued that bodies in a phylitic group possess many traits in common *because* they are in the same phylitic group; similarities are *synapomorphies*.

Although the present research did not intend to offer any cladistic iteration (for reasons given in §2.4.2.4), both cladistics and history can help us to comprehend the results. Irresolvable controversy has been the prominent cause of schism in religious organisation[18] and the resulting splinter groups carry a cluster of essential defining characteristics, which may or may not be the fuel for subsequent dissent. Some clear historical examples are the rents over papalism, which split the Protestants from Roman Catholicism; sabbatarianism, which is associated with Adventism (e.g. SDA); and spirit baptism, which is linked to Pentecostal movement (see Appendix F). Both the sets of traits and splitting events are at the rank of *denominational family* (§3.3.3.2) and generally, any *religious body* within a denominational family, along with common ancestry, will share a set of defining traits. It is the essential defining characteristics of a group that seem to allow this relative match at the mezzo-level. However, an alternative interpretation is inherent essentialism precipitating from the data sources. Whatever the reason, this match completes the four methodological criteria and can be counted as successful (§4.2.3).

The result of having 3 levels was unexpected but may be important for future research, especially in the development of a specific metric of tree similarity.

3.5.2.3 What shows not shows

Applying the methodology to a pilot group of Western Christian denominations has met with the selection and minimally the first three methodological criteria as well as the necessity of testing the method upon a real organisational form.

The results have highlighted the flaws of a naïve assumption concerning the relationship between the phylogram and phenogram while at the same time suggesting a solution to the problem. Phenograms are not indicators of descent and they cannot

[18] Such as the present divisions over homosexuality in the Anglican Communion.

necessarily be matched directly against descent. Hence, although the levels of denominational family and religious body can be forced into a match, this cannot be taken as success.

The relative matching, on the other hand, provide a convincing mapping as they are thought to be coincidentally improbable. If this is correct then the fourth methodological criterion has been met from which it may be inferred that there is a pattern of traits that is in alignment with descent. At least for the pilot group, there are indications of an inheritance mechanism that is consistent with what meme theory would anticipate. While the test case may have some success, the implications for the methodological hypothesis will be viewed in part 4.

The pattern is showing that articles of faith, ritual, and structure are being passed on through teaching but variations have resulted in schism and a pattern of divergence. Denominational families are identified both by their history and their essential defining traits, where events have been causal to sectarian characteristics. The preceding could be a description from comparative religion, but is it telling us anything that we don't already know? Well, the significant difference is that the memetic perspective puts the emphasis squarely on the survival benefits for the underlying substrate. All the vestiges of the church simply become expressions of, and vehicles for selfish memes subject to the blind forces of reproduction variation and selection. Darwin not only explains the survival of the fit but also the survival of the faith.

3.5.3 Auxiliary findings

Appendix M, rather than the main text, presents other results and inferences that were interesting from a memetic point of view. This includes experimental re-weighting of the "bishop meme" which influenced the structure of the macro level results.

3.6 Conclusion to faith testing

> I understand everything about fundamentalist Christian theology; raptures, pre-millenarianism, dispensationalism, total depravity, predestination and irresistible grace (yes, I am Scottish, in case you were wondering). However I don't believe a single word of it. By contrast, when it comes to Darwinism, I both understand and believe. [Gatherer, 1998]

Most theorists or theologians attempt to prove why a given theology is either right or wrong as opposed to how it came about. Although a Darwinian view of Christianity may appear polemic, faith propagation (in spite of evidence) suggests a purely memetic strain. The meme offers a means of understanding the nature of faith and religion has made frequent cameo appearances in writings on memetics.

Western Christian denominations have provided a suitable pilot group by which to test the memetic methodology while at the same time furthering the scientific investigation of faith. Although the methodology has had some shortcomings, the meme has offered a plausible explanation for the diversity of faith[19] and suggests the mechanisms of schism and preservation of orthodoxy, which may form the basis of more specific study. For seminarians, the phylogenealogical and phenetic iterations may be useful in reconstructing the family of Christ.

Within the context of the present research however, performance of the pilot test has shown that the majority of the method is feasible; the weaknesses lie in the final comparative stage, which the unanticipated mezzo level may help to rectify. To conclude with religious bodies, it has been their essential defining characteristics at this mezzo level that has given some support the methodological hypothesis.

More general conclusions with respect to organisations will be drawn in part 4.

[19] A long-time personal curiosity since I asked my mother, as many children do, why there were so many religions if there was only one god.

[i] The fly is captured on the web by http://www.ceolas.org/fly/intro.html

[ii] A few of the main Kung Fu styles are listed http://www.shaolin.com/page.asp?content_id=973

[iii] University of Virginia's religious movements page http://religiousmovements.lib.virginia.edu

[iv] Source data of adherents distribution http://www.adherents.com/Religions_By_Adherents.html

[v] Definition of parachurch http://religiousbroadcasting.lib.virginia.edu/parachurch.html

[vi] http://religiousmovements.lib.virginia.edu/cultsect/anticounter.htm makes the distinction between anti-cult and counter-cult organisations.

[vii] Foster's Typology (1995) http://www.interlog.com/~winters/articles/typology.html

[viii] http://www.adherents.com/classify.html example of classifying faith ranks

[ix] Melton's family groupings http://religiousmovements.lib.virginia.edu/profiles/listmelton.htm

[x] Identification of sects http://www.xenos.org./classes/papers/sects.htm

[xi] The watchman fellowship http://www.watchman.org/watchman.htm

[xii] Ontario consultants for religious tolerance http://www.religioustolerance.org/toc.htm

[xiii] Why Chrisitans Suck http://www.Paranoia.com/~wcs/

[xiv] http://www.faithfinders.com/ a search engine for congregations

[xv] Southern Baptist Convention http://www.sbc.net/

Part 4: Evaluation of a Memetic Methodology

Note that, in its own terms, whether or not the meme meme replicates successfully is strictly independent of its epistemological virtue; it might spread in spite of its perniciousness, or go extinct in spite of its virtue.

Daniel C. Dennett, *Darwin's Dangerous Idea* (1995 p364)

He turned to go and paused. "Oh. One last thing, if you will. The word in the heading. Cliological. Do you know what it means?"

"Cliological?" she frowned. "No, I never- Oh!" She laughed.

"What is it?"

"Clio was the Greek muse of history. Apparently, the writer or someone, coined the term as a parallel to biology or sociology, meaning 'a science of history.' Perhaps the writer was a science student taking a history course."

Micheal F. Flynn *In The Country Of The Blind*

4.1 Evaluation Introduction

Knowledge is arguably a memetic fitness landscape (Gabora, 1997) and the satiation of one curiosity only leads to more perplexing problems – fractal crevices in understanding. Darwin's ideas about species lead to questions about social evolution. These questions, which after being suppressed as social Darwinism, found sanctuary with the neutral concept of cultural replication. Memetics itself has spiralled, raising speculation into all areas of human activity and has brought with it the particularly knotty conundrum of social organisation.

As to *what organisations are* is a big question that affects each one of us and the approach herein has been to reduce it further and further into more specific and manageable chunks[1] with the hope of answering a small part of it. From theory existent in the literature, through the abduction of a methodological hypothesis from biological models, methodological development, translation and construction of the method, software implementation, pilot selection, data capture down to number crunching.

In the light of performing the pilot study, results can be generalised and built back up so as to fill the gaps in the existing theory explored in part one. Although faith groups are a small and peculiar part of the abiota, they have contributed a test *en route* to a theory of organisational memetics.

4.1.1 Objectives and structure of the evaluation

While part three specifically dealt with religion, this section will provide an appraisal of the methodology, examining where its successes, failures and areas for improvement with respect to the objectives.

It is worth reviewing the problem, the research aims, and the methodological hypothesis before embarking upon evaluating the extent to which the actual research process solved, met, and confirmed respectively.

[1] As per the epistemological assumptions in §2.2.1

With this, and in light of the pilot, then both the method and methodology's strengths and weaknesses can be evaluated; ideas for further methodological developments, refinements & corrections can be proposed.

It is expected that parts of the method may find application in other research areas. Furthermore, a practical tool for organisational development and strategic analysis is anticipated. Finally the researcher will take the opportunity to make some personal comments and aspirations for the future of the emerging science of memetics.

4.2 Evaluating the research

While methodological development proceeded from theory to practical research activities, evaluation is best done in reverse order. Strengths and weaknesses will be highlighted here while suggested corrective action or refinement will be proposed in a subsequent section (§4.3.1). After restating the aims, the method's components will be reviewed in terms of how effective they were as individual algorithms. Assessment will then be done regarding: how well the method met with the aims of the methodology; and to what extent the methodology answering the research issue.

Although questions over what organisations are and whether the organisational "gene" hypothesis provided clues, were beyond the scope of this research, they provided a basis for it. Implications of the results are considered from both the perspectives of organisational and general memetics.

4.2.1 Restating the aims: the measure of success

Part one presented a barrage of difficulties facing organisational science and proposed that a scientifically based classification of organisations, may act as the foundation for better development. The question becomes can organisations be classified naturally? (§1.1.2) Arguably, memetics offers the bridging concept that enables natural science to do justice to the complexities of society and culture. Ultimately, the possibility of designer memes may transform the management of organisations.

The initial objective has been to understand and clarify the nature of the problem and to locate where research can best help. It has been argued herein that, under the

constraints, the greatest contribution would be gained from performing the methodological groundwork, focusing on the question of feasibility of a memetic methodology. In doing so, this research begins to claim that memetics can be a valid and practical science.

Understanding what the *organisational "gene" hypothesis* implies has been essential to the core research objective: to see whether or not it is possible to construct a method that suggests trait inheritance in *real-world organisations*.

- *Firstly the establishment of rational criteria* by which to evaluate a method were needed.
- Secondly, the processes needed translating and validating against idealised simulations (part 2 and here in §4.2.2).
- A *sufficient and necessary* condition was that the proposed process be tested upon *one* actual sample. Hence, *thirdly*, a suitable organisational group had to be selected (part 3).

A by-product of evaluation was to provide a first test for organisational "gene" hypothesis thereby lending supporting evidence to pre-existing memetic theories while at the same time encourage the development of memetics as an empirical science.

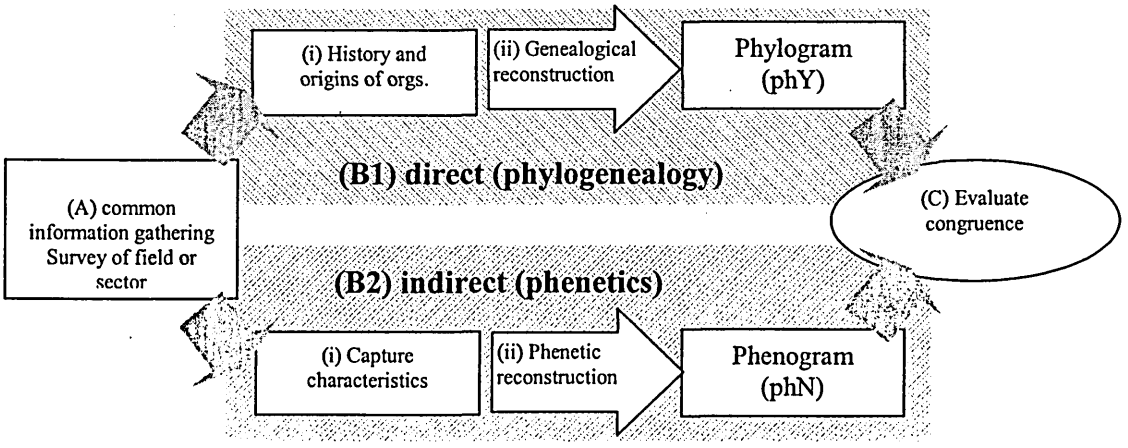


Figure 4-1. Activities involved in the method and evaluation

4.2.2 Evaluation of the method

The prescribed method (§2.5) has been applied to the pilot (§3.4) and examined from the perspective of religion (§3.5); here, broader aspects of the method are considered

along with how the various components generalise. The familiar diagram in 4-1 shows the method's stages.

4.2.2.1 Common information gathering

Stage A was concerned with getting a feel for the sector in question, locating data sources, and establishing what taxa to include or exclude. As commented (§2.5.2) this phase of the process can afford greater flexibility to explore the domain in question. Conducting the process demonstrated that it was successful. Particularly important was the ability to incorporate new taxa as they came to light. Perhaps the main area for improvement would be in providing some clear criteria, or at least some guidance, for taxa inclusion and also how many to include such that results are significant. There was a weakness in that it was sometimes difficult to differentiate between what could be called a religious body proper and other phenomena such as: parachurch groups, bible societies, movements, or revivals. For example, it is arguable whether the Millerite Adventist movement or the City of Zion should have been omitted, as these were transitory phenomena that influenced the emergence of new denominational families. Another difficulty was that de-selection of a groups was often brought about much later in the method when it became clear that insufficient data was available (e.g. capturing characteristics). Spotting these problem bodies at an earlier stage would have saved much effort.

4.2.2.2 Phylogenealogy: historical iteration

Stage B1 provided a diachronic reconstruction directly from historical records using "phylogenealogy". Although prominent schisms in faith groups are well documented, the translatability of genealogical methods to produce an "organisational phylogeny" was initially unknown. As the investigation progressed it turned out that the origins of the majority of faith groups were easily established. For other groups, historical ambiguities, contradictions, or confusion impeded research; use of several sources of information provided clues by which to piece together ancestry.

Essentially then, translation of the method for constructing the direct iteration produced a convincing reconstruction of faith phylogeny; this met with the first (diachronic) criterion for the methodological test. Religious groups provided the pilot and provided a relatively straightforward case yielding a plausible phylogeny.

However, had the first test have failed, or proven too difficult, then other candidates would have been tried. If no suitable pilot groups could be found then the methodology would have been unworkable (by the first criterion). That case might have suggested the absence of lineage; the pilot however, indicated otherwise.

So far phylogenealogy has only been applied to a small subset of the mainstream western religious bodies; it is unknown to what extent this process might generalise[2] though thought to be suitable to any object that has traceable ancestry. There are two potential difficulties: the first is the availability and integrity of historical information as either organisational origin may have gone undocumented or they may be reticent, for whatever reason, to make their history public. A second, and more serious, problem is that an organisation may have multiple "parentage" thereby presenting problems analogous to hybrids. As Dennett (1995 p356) puts it, *'lines of descent are hopelessly muddled'* and it almost certain that many organisational forms do have muddled lineages. Many cults and "pastiche" theologies serve as examples; Joseph Smith's (non-metaphysical) inspirations for the book of Mormon might never be fully mapped.

Faith groups, by definition, place a premium on fidelity; business organisations are probably considerably more promiscuous. While it would be easy to adapt the mechanics of the phylogenealogical method for handling a multi-parental situation, the difficulty would be in establishing the parentage.

4.2.2.3 Phenetics: ahistorical iteration and meme mapping

Stage B2, independently provided a synchronic reconstruction indirectly from organisational traits. As stated in part 2, numerical taxonomy is an extremely general algorithm that can be performed on any set of characterisable phenomena or putative meme strips. Hence, the generated dendrogram is independent of organisational sector, characters chosen, their accuracy, or implications of descent. However, an issue, with a serious implication, came to light during the test.

[2] The successes of organisational cladism (Fernandez & McCarthy, 2002; Tsinopoulos & McCarthy, 2002) indicate the wider application however.

It was easy to generate an extensive list of characters; while being valid in terms of numerical taxonomy, this was not particularly advantageous for the study. In asserting each new character, it became necessary to ascertain that character's state for every religious body. Doing so was dependent upon the accessibility of information; for obscure traits this task was impractical. Essential characters, idiosyncrasies, deviations to the norm, and unorthodoxy, such as peculiar practice or belief, tended to be well documented. Some of the lesser characters, in the researcher's judgement appeared to be meaningless[3] and so, in practicality, were omitted from the study.

Axing these "meaningless" traits, so as to avoid the impracticality of a geometrically expanding research effort, raises a question over the research's interpretation of phenetic methodology: does it skew the outcome to form a false result? This issue will be taken up later in the methodology's evaluation (§4.2.3).

The other problem with phenetics is the vast array of association and clustering options to choose from. Although it would be interesting to experiment with the various permutations to see what influence differing assumptions might have on the dendrograms, for reasons outlined in the next section, it is unlikely that they would be significant.

4.2.2.4 Evaluating Congruence

The two independent iterations are brought together in stage C: evaluating congruence, which ideally would have involved a mechanistic algorithm. Unfortunately, the researcher could ascertain neither a reliable metric nor method for comparing phylograms against phenograms. The imposition of non-technical constraints enforced manual processing and subjective judgements of comparisons (§2.5.5). MENDEL's results were copied to a graphics package where the branches were coloured, abstracted and "rotated" (appendix A) using the mouse. Furthermore, the time and effort involved to make a manual comparison placed restrictions upon

[3] As an extreme example, comparing the religious and Facilities Management meme characters (§4.3.1.2) supports intuition that different organisational sectors emphasise different traits. Trying to establish say W. S. Atkins' position on spirit baptism is almost entirely without meaning and unlikely to be documented (examples are a plenty *visa versa*). As both FM and religion are forms of organisation then hypothetically, there must be some commonality however remote, and on an evolutionary basis such traits would be *sympleisiomorphic*[3] (primitively shared). It may be possible, though somewhat pointless, to map a full organisational *memeome*.

the number of possible tests making experimentation with other association or clustering strategies impractical[4].

Lack of sophistication in this area was a serious weakness for the methodology (more detail in §4.2.3). The test did show a general congruence at both the macro and micro scale, and this was initially taken for a successful result. However, on later reflection neither the macro level nor any of the micro levels contained sufficient *phena* to make a match significant (see §3.5). The process, being slow and laborious, had exacerbated subjectivity and the flaw had been overlooked. If the process had it been automated then it is likely that the results' flaws might have been spotted and rectified much earlier.

Because of the micro and macro problems, the "mezzo" level became the focus of analysis. Rather than attempting to find a *direct match* between trees at both levels, a *relative match* was sought: the relationship between the OTUs (religious bodies) and their clusters (denominational families) were found in both trees.

Figure 4-2a exemplifies, where comparisons made are (with just the middle group)

$_{phN}$ <A, P, X> against $_{phY}$ <A, P, X> at the macro level and

$_{phN}$ <p, q, r> against $_{phY}$ <p, q, r> (etc.) at the micro level.

Figure 4-2b, on the other hand compares inter-relationships between OTU and group.

$_{phN}$ <p:P, q:P, r:P> against $_{phY}$ <p:P, q:P, r:P>

[4] The testing of other strategies was unnecessary for the purpose of the research. However, the ability to compare other combinations of strategy (i.e. Wagner, Jaccard etc.) may have been informative.

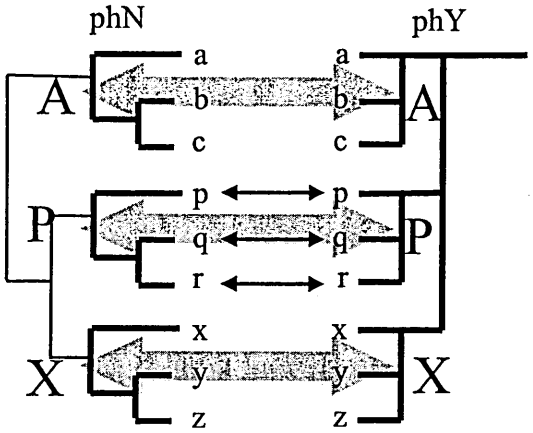


Figure 4-2a direct macro and micro comparisons

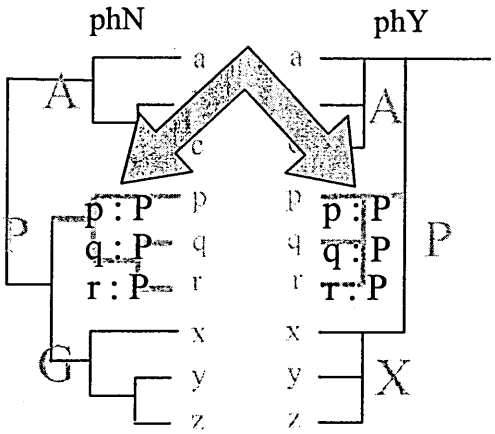


Figure 4-2b indirect "mezzo" level comparisons

As noted in part three, this mezzo level method was considerably more successful in that the results were not coincidentally probable. To abstract the pilot case, it broke down into a small number of groups containing a small number of members. It might be relative matching may generalise to where this breakdown occurs (and might even return back into the biological domain; future implementation is considered in §4.3.1.3). On the other hand, where there appears to be one large group then direct matching may be more appropriate. As far as the association and clustering options available to the phenetic iteration go, they are most likely to be useful where direct matching is chosen.

The methodological implications and the difficulty of the mezzo level involve the "essential" and "meaningless" traits problem (§4.2.2.3) that will be dealt with later (§4.2.3).

4.2.2.5 Overall method review

The method is dependent upon comprehensive, explicit, and accurate secondary data both historically (diachronic) but also characteristically (synchronic); given such then both iterations however appear to be sound. It is speculated here that, complementary iterations that provide primary data capture would confer greater accuracy to the data capture requirements.

Although most of the method is algorithmic and automated, major weakness stem from unavoidable human judgement: choosing the taxa, selecting the characters, determining the character states, and comparing the resulting trees. Explicit criteria have been introduced and expressed in an attempt confer greater objectivity and consistency.

The method's greatest weakness is clearly the tree comparison, and given sufficient resources, it may be possible to make substantial improvement. Apart from the non-automated and subjective elements, overall the method's components fit together and work quite well.

4.2.3 Evaluating the methodology and its hypothesis

The central topic, as the title implies, is *developing and evaluating a memetic methodology.* The principle task is testing the methodological hypothesis. Here, the methodology proposed in part 2, will be assessed in light of the pilot.

One component of the isomorphic proposition (§2.2.1.3) provided the *methodological hypothesis* (§2.4.1.5): that there is a feasible method for indicating the presence of a mechanism of trait inheritance among at least one group of *real-world* organisations. To meet this aim, three sub-objectives were determined.

4.2.3.1 First objective: Establishing rational criteria

Firstly the establishment of rational criteria by which to evaluate a method were needed. Four methodological criteria were derived (§2.4.2.3) which demanded that two independent reconstructions which matched as follows:

1. *A method of reconstructing an accurate pattern of descent.* "Phylogenealogy" complied because it used only ancestry based upon historical evidence to reconstruct descent without regard to any other trait.
2. *A method of clustering a pattern of resemblance.* Phenetics (numerical taxonomy) met this criterion as it formed grouping based entirely on trait similarity *without* regard to historical information.
3. *The two methods are mutually independent.* Compliance with this criterion resulted from careful selection methods that fitted the first two criteria. The

synchronic and diachronic axes are mutually orthogonal: phenetics is based entirely on trait data, phylogenealogy entirely on ancestry.

4. *The pattern of trait resemblance sufficiently matches the pattern of actual descent.* The inference of a match is that resemblance is *because* of descent implicating a mechanism of inheritance (i.e. meme).

The first three criteria are easily met; it is the fourth criterion is the acid test of the methodological hypothesis and requires further evaluative analysis. In terms of method, the *comparison* stage is the weakest link (§4.2.2.4); assuming that a robust process or objective metric might be found at some future point, then is the criterion itself valid?

4.2.3.1.1 Direct and indirect matching: revising the outcome matrix

The review of the pilot study showed that the phylogram and phenogram could be made to "match", and in doing so brought into question what this "match" actually meant, if indeed it meant anything. In retrospect, the direct comparisons might have been unwarranted on the basis that they were trying to equate unlike structures with dissimilar behavioural properties; a phylogram is not a phenogram[5]. Failing to see this (type 1 error) in the first instance (explained in §4.2.2.4) fostered the belief that that the *match-absent* case (within the outcome matrix §2.4.2.4.3) was a combinatorial improbability when actually the accidental chances were far greater. Direct matching was most likely to produce a match irrespective of inheritance; the probability of a false positive indicated that the results were not so meaningful (in the absence of a metric).

Using the direct match approach made it undecidable as to whether the match actually represents inheritance or is simply a fundamental flaw in the methodology (table 4-1); we would have to default to the null hypothesis: the absence of a replicator. Furthermore, the methodological hypothesis (of a feasible method) according to the fourth criterion would neither have been supported nor falsified; but like Edison, we have discovered another way that it doesn't work.

[5] Using another tree-reconstruction method may made criterion 4 (matching) easier through comparing *phenogram* against *phenogram*, however criterion 3 (of mutual independence) would have violated (see§4.2.4.3).

While a *direct match* may have been misleading, the "mezzo" level enabled a *relative match* to be seen (§2.4.2.4) that probably suggested a significant pattern. In doing so it re-established the outcome matrix (table 4-1). In terms of the pilot's results, the fourth criterion of a suitable match is satisfied. The indications are: the presence of inheritance in at least one case and that a memetic methodology is at least possible. The methodological hypothesis is thereby supported.

It is possible that the revised outcome matrix might apply to samples that can be broken into macro and micro level groupings (perhaps because of reasons discussed in the next section); where there just one large group then the original matrix might be more suited.

Revised outcome matrix		Phenogram / Phylogram comparison: method and result			
		Direct (micro & macro)		Relative (mezzo)	
		Mismatch	Match	Mismatch	Match
Inheritance mechanism	Absent	Unlikely irrespective of presence or absence of inheritance	Likely irrespective of presence or absence of inheritance	No support	Improbable (subject to sample size)
	Present			Erroneous methods or muddled lineage	Support (pilot results)

4.2.3.1.2 Monthetic inheritance

The relative match solution raises a further methodological issue. Actually, the problem wasn't with phenetics, but rather was inherited from a tacit historiographical assumption. Although the non-objective and biased nature of historical narrative was considered at the outset (§2.5.4.1.2), the trouble was only identified upon evaluating why relative matching worked (§3.5.2.2).

The axing of "meaningless" traits (to keep the phenetic iteration within the boundaries of practicality; see §4.2.2.3) raises the question as to what constitutes *meaning*. Documentation tended to focus upon idiosyncratic features, deviations to the norm,

unorthodoxy, and peculiarities; that is, narratives were implicitly constructed around Aristolian essentialism and monthetic typologies.

In difference to monthetic typologies prevalent in the humanities and social sciences, this research attempted a polythetic classification (i.e. phenetics) in line with McKelvey's organisational specie concept (1978; see §1.2.2.3.4)[6]. One way of interpreting the success of the mezzo level match (§3.5.2.2) is that: the essential defining characteristic of the denominational family is inherited by each religious body it encompasses. Another perspective is that the essentialism inherent in source narrative has subtlety leaked into phenetic reconstruction. The obvious way around this, given sufficient resources, would be to bypass the infected narrative (§4.3.1); but short of doing so, is there actually a problem?

What has gone unmentioned so far is that which the methodology has actually been tested upon. Clearly, secondary data reported by various authorities is being used rather than accessing organisational characters directly. From this arises an obscure and awkward point: is the method operating on the reported characters, or characters of the reports[7]. This point can be overlooked as, in either case, the all four criteria are met. So, whether the traits actually reflect reality, or appertain to historically generated simulacra, or whether they are contaminated by essentialism, is besides the aim of the methodology. The two independent iterations have produced an encouraging match thereby supporting the hypothesis that a memetic method is feasible.

4.2.3.2 Second Objective: Translation of processes.

Secondly, the processes needed translating and validating against idealised simulations. This objective was relatively straightforward principally because phylogeny and phenetics, while associated with biology, are actually abstract mathematical algorithms well known to graph theory and cluster analysis. They weren't so much translated from biology but rather biology provided a practical

[6] Perhaps a further feature of the isomorphic proposition is that social systematics is progressing in a similar way that biological systematics did.

[7] Historiography can be seen here from a memetic point of view.

example of their instantiation. Many of the weaknesses of the organisational application were already present in the biological form.

Once more, the Achilles' heel was meeting the fourth criterion, as there was no available example of comparing the two trees.

4.2.3.3 Third Objective: The pilot study

A sufficient and necessary condition (that the method works on real-world organisations) was that the proposed process be tested upon one actual sample. Hence, thirdly, a suitable organisational group had to be selected.

Other than making sure that the methodology did not remain a theoretical abstraction, it is interesting to consider what issues the actual test has brought to light along with the methodological flaws that might otherwise have gone undetected.

- The prediction of a distinction between General and Particular Baptists asserted from an inconsistency between characteristics and lineage (Appendix M).
- The concept of canonical memes that preserve the state of, and propagate, other memes (also Appendix M). These are typified by the "bishop meme" of Episcopalian polity.
- Merger of lineages where they have not become too distinct. It was originally considered (but not expressed in part 2) that the pattern would be strictly divergent.
- The problem of *direct matching* between phylogram and phenogram and the solution of *relative matching* at the mezzo level. This was initially overlooked being misinterpreted as a success. Without the pilot it is unlikely that it would have been found and rectified by a shift in method.
- The impact of monthetic typologies in polythetic classification was only recognised by attempting to rationalise the success of relative matching. This lead to a realisation that the characterisations may pertain to the reports of organisations rather than the organisations themselves.

It was specified that a pilot would be sufficient and necessary, but this is erroneous as it presupposes a negative result implies unfeasibility. Feasibility is only contingent upon a *positive* result. All that can be ascertained from either a negative or an undecidable result is that the methodological hypothesis is unsupported. The outcome matrix (both revised and in part 2) shows this.

Considering the result given by relative matching upon the pilot then the memetic methodology developed herein, would appear to be feasible. Had it not, then other candidates might have been tried (indeed others may be tried and each success would reinforce the claim). One related principle was that the methodological hypothesis was falsifiable which originally provided by the mismatch-absent quadrant of the outcome matrix. While the hypothesis remains falsifiable, the methodology's refutation became diluted into just a lack of support; future incarnations may hold greater certainty about a negative result.

4.2.3.4 Conclusion

It has been argued (§1.1.3) that memetics, in its current state, would gain the most contribution from research that performed the methodological groundwork. One approach is in attempting to show the possibility of a method suggestive of trait inheritance in real-world organisations. To this end, a memetic methodology has been developed, piloted and evaluated and in the process, has revealed much about the subject.

Firstly, the four main criteria of independent yet congruent iterations have been met through processes translated from biology. Through piloting, on religious organisations, certain weaknesses were revealed that would otherwise have gone unnoticed and uncorrected, particularly the matching method. In attempting to explain why relative matching worked, it became apparent that essentialism might be leaking into the phenetic system. This further raised the question of what was being characterised. Faith groups met with the conditions, but it later became apparent that the methodological hypothesis did not have a criterion for falsification.

In review, the research has suggested that memetic methodologies are feasible but maintains that both more robust processes and extended studies are desirable. In spite of its limitations, this research can claim that memetics has the potential to be a valid and practical science.

4.2.4 Organisational memetics & the "gene" hypothesis

With the memetic methodology developed and evaluated it is time to step outside the formal objectives and look at how the results relate to the original research

inspirations: organisational naturalism and the organisational "gene" hypothesis. From hereon, any assertion is a theoretical extrapolation.

4.2.4.1 Implications for the organisational "gene" hypothesis

Although the research could not possibly prove the universality of the organisational "gene"[8], the necessity of a pilot did involve a first test of that hypothesis. In concluding that a memetic methodology was feasible, the level of match between trees was some way consistent with variable trait inheritance in religious organisations and therefore upheld the basic premise of the meme as non-genetic replicator.

There are distinct analogues between the biota and abiota that point to a possible natural science of organisations and by the isomorphic proposition other constituents may be translated from the biological model (§2.3). The theoretical derivation of the organisational "gene" hypothesis suggested that the meme concept, might furnish a

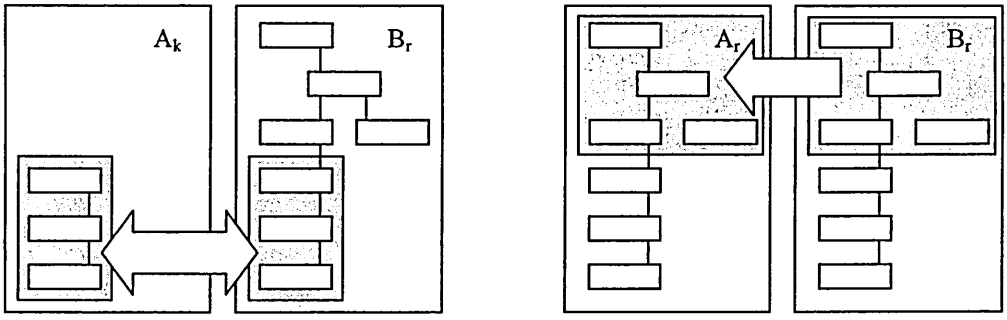


Figure 4-3. Translating constituents into the organisational model

consistent theoretical[9] basis to balance the other constituents of a naturalistic organisational model. If the results are indicative of a replicating substrate in the pilot then sense can be made of the other constituents: reproduction, character inheritance, replicating substrate, expression, variation, mutation, speciation through cladogenesis, and phylogeny.

Of course, the pilot is an idealised example, and it may be more difficult to isolate patterns in more turbulent systems than Christianity. But by observing other

[8] A more precise definition of the organisational "gene" hypothesis §2.3.2
[9] A meme theoretical approach to each of the model's elements has been reviewed in part 1.

organisational forms it may be possible to recognise the constituents (exemplified in §2.3.1 point v) as telltale Signes of memetic replication.

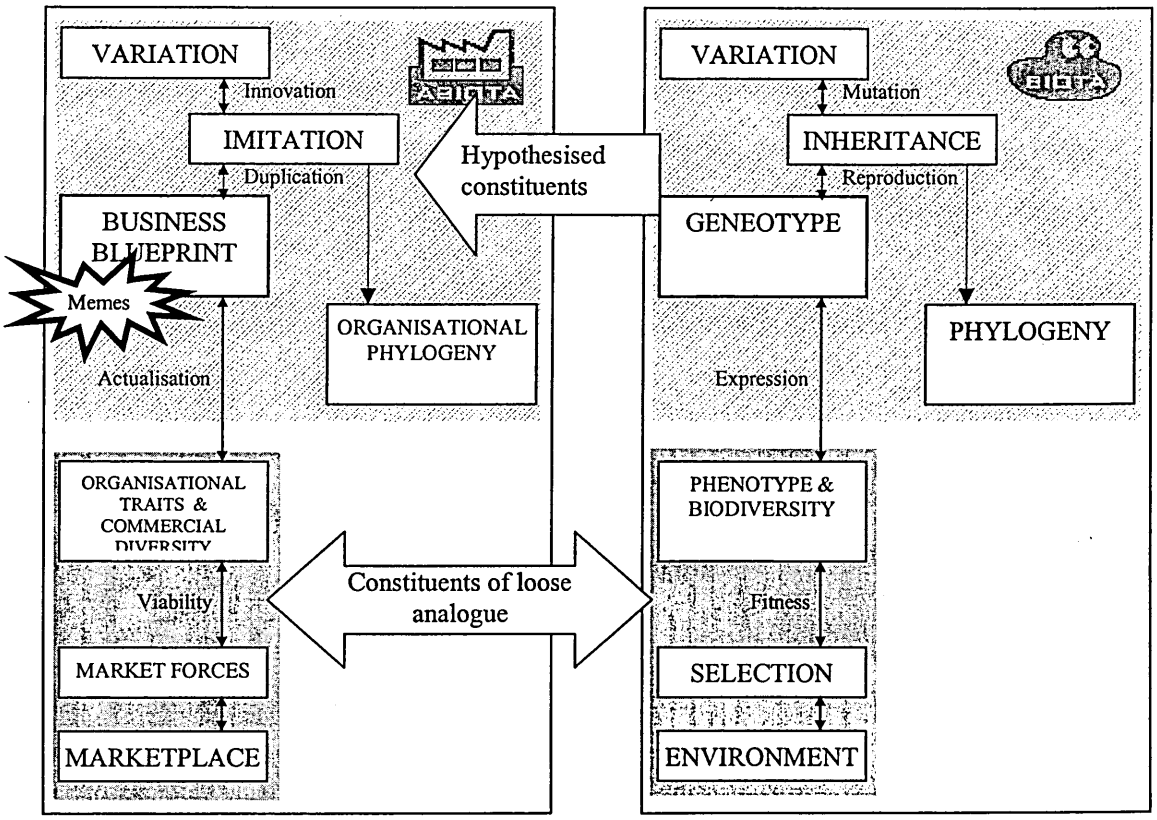


Figure 4-4. Biotic inference of characters in the abiota

4.2.4.2 Implications for related theories of organisational evolution

The newly emerging field of organisational memetic promises explanations for much social activity. While the current research is bounded to exploring just a tiny chunk of memetics' organisational application, its theme is foundational. The role of memes in organisations, markets and commerce has been speculated but evidence has been more anecdotal than methodologically derived (§1.2.4). The case, albeit limited, gives some evidence of the presence of memes thereby complementing the more theoretical approaches. Moreover, the findings of the present research have added weight to the conjectures posed by those who take a memetic or evolutionary stance on organisations.

The origins of this research were in Morgan's (1986) *organisations are organisms* metaphor, to which Tsoukas (1991) considered much more rigour could be brought (§2.2.1). Reconciling social and natural sciences has long been a goal of positivism

and the meme was suggested as a theoretical keystone by which to bridge the two domains; positively identifying its involvement would be a step towards a natural science of organisations. In spite of the present research's teething troubles, it has at least shown that memetic methodology is feasible.

The results also make McKelvey's (1978) concept of the organisational specie more solid. In the test case *religious specie* is represented at the rank of *religious body*, the genus is the *Denominational family*[10], and the individual equates to the congregation (reflecting adherents.com, §3.3.3.2). It is uncertain at this point precisely how multinational corporations, commercial enterprises, or the apparatus of government (etc.) may be ranked though presumably the idea has considerable merit. It is plausible that within the "abiotic domain" there is a rank that both faith groups and commerce share. Routines and competences, in the study, have had metaphysical analogues in systematic theology (rituals and beliefs for example), which have enabled polythetic groupings to be constructed using phenetic methods. These have been considered as expressions of *meme strips*, which at least for religion, suggest a pattern of descent consistent with organisational evolution thereby backing up Aldrich (1999).

Cladistics was rejected in favour of phenetics because of the *a priori* assumptions that conflicted with the third criterion (mutual independent reconstructions). Although McCarthy et. al. (1997) have applied cladistic methods to manufacturing evolution, this is done in the absence of a proposed inheritance mechanism yet carried the *a priori* assumption of decent with modification (§2.4.1.4). It was argued that, should these methodological difficulties be resolved, cladistics and other methods would become powerful tools for exploring organisational descent based on routines and competences. The current research has tested that which cladistics presumes and, in showing that the meme might account for organisational evolution, helps make organisational cladistics into a complementary iteration.

The test certainly supported the idea that institutional rules do have a memetic basis (Speel, 1997; De Jong, 1999) or Langrish's (1999) *explanemes*. Religious bodies

apparently inherited and preserved theological traits by encouraging adherents to have faith. The memetic bases of rules were no more evident than in Episcopal polity, papal infallibility and in biblical inerrancy (appendix M), whereupon removal resulted in institutional breakdown and schism. Analogues can be identified for non-religious organisations particularly hierarchical bureaucracy, which mimics episcopacy.

Patterns in the study were predominantly fissiparous (though found to be not strictly divergent), as irreconcilable arguments forced schism, or at least old faiths found new expressions (Mather & Nichols, 1993) the new world invited new strains. Similarly, new business start-ups emerge as new commercial niches open or markets develop. Organisations don't only split and Vos & Keller (2001) have suggested that '*managers use mergers and acquisitions to enhance their power*', whatever "power" means, rather than for some sound financial objective. Similarly there were events where denominational lineages did reconvene (e.g. in both Methodism, Pentecostalism) and the explanation proffered was that variants of a sub-species rank were not sufficiently disparate to prohibit merging. It is unknown at this time whether corporate mergers are disanalogous to religious ones; whether such events represent reproduction or consumption; or something else entirely.

The argument that organisations change through *punctuated equilibrium* rather than gradualism (Price & Evans, 1993) was borne out by blooms at such times as the reformation. As suggested, papal power maintained equilibrium through various instrument of heresy suppression[11], which Luther's actions punctuated - thereby opening faith space exploration. Similar canonical memes may be acting as '*invisible antibodies to change*' (Price & Shaw, 1998), cementing corporate traditions thereby choking innovation; the dinosaur metaphor of monolithic organisations becomes apt. The removal of critical "old guard" as defenders of the corporate faith does appear to till the soil allowing new memeplexes to germinate as Price (1997) illustrates with the newly appointed CEO who blew up the corporate headquarters.

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[10] It may be tempting to produce a parody of binomial nomenclature – However, the researcher considers such a system somewhat misleading and obsolete.

[11] As exemplified by the inquisition inaugurated by Pope Sixtus IV
http://www.newadvent.org/cathen/08026a.htm

4.2.5 Contribution to general meme theory

While the research was interested in organisational memetics specifically, there are many implications for a more general science of memetics. The possibilities are wide and a full appraisal with respect to the literature review (part 1) is unavailable; the main areas of contribution will be overviewed.

Memetics, as noted, has had a tradition of theorising, producing conceptual models or producing defences as to why it should be seriously considered as a science (De Jong, 1999). The field has been stuck in the doldrums of *era 2* (§1.2.3). In spite of Dennett's (1995) pessimism and Midgley's (1979) fears, Hull has made a call to action for establishing a proper science of memetics.

This research has methodologically provided a certain amount of evidence compatible with the abiotic replicator hypothesis. However and perhaps ultimately more importantly, the program has shown that rigorous empirical approaches to (organisational) memetics are no longer just a theoretical possibility. Admittedly, the fledgling research method might have many imperfections but it demonstrates that empirical memetics is a promising area worth pursuing.

There are implications with respect to existing literature and the test adds weight to arguments within Rose's (1998) four controversies. Firstly, establishing putative "meme strips" for the purposes of phenetic methods was based upon positive observable traits (or at least observed and documented by others) and therefore took the external perspective. Interestingly, theology added a third, spiritual dimension to the internal/external debate. However, as metaphysical data capture is a contradiction in terms and within the neo-positivist epistemology of the study, then Gatherer's (1998) point was accepted and only externalised traits (as potential expressions of memes) could be considered[12].

Secondly, religious bodies did not appear to acquire characteristics and pass them on as per Lamarckian evolution, but rather the acquisition or change of state in a characteristic generally precipitated schism in a more cladistic and Darwinian way.

[12] The miracle of transubstantiation serves once again as an example of where only the outward manifestation of the ritual is observable.

Although it is evident that organisations do change (eg. Church of England today is not what it was a few centuries back) Darwinian rational may be preserved. Although a faith group's *name* (literally *denomination*) is a selfish meme in itself and may have made itself desirable to its adherents, vernacular nomenclature has proven to be unreliable (cf. 'Baptist'). It can be conjectured that the "loosening of some canon" may have brought about a bloom of minor schisms and sub-schisms. Herein the corpus of adherents may have passed through a series of slightly different views (organisations) and finally attracting to a stable memeplex while competing recessive combinations atrophy. The *name* meme, in an act of self-preservation, may have tagged onto the surviving dominant organisation's memeplex, which would give the appearance of internal organisational change. In this speculative way, acquired characteristics are not passed on and organisational evolution is Darwinian.

The third controversy was whether memetics was sociobiology and it has been argued that, by definition, it could not be. While Reynolds and Tanner (1983) have argued that dogma encapsulates strategies that confer survival and reproductive advantages, the study found no compelling genetic precept for the religious bodies or their traits. Many of the traits encountered seemed to be counter-beneficial to biological needs and indeed the Adventist clade's fundamentalist eschatological preoccupation invoked numerous human tragedies.

Rose's final controversy was as to whether or not we can *rebel against the tyranny* of our selfish replicators. Unfortunately, the study itself was less than consoling on this matter. It did however suggest that certain memes are lynchpins (c.f. appendix M) to change and the methodology's *meme mapping* system might form a way (subject to "free will") of identifying which to change. It will be proposed that the methods of investigation may form the basis for methods of intervention (§4.4).

The study also supported Gabora's (1997) prerequisites for evolution in that the putative meme strips based on organisational traits provided a Boolean *pattern of information*; switches (of hermeneutic context) provided a means of *generating variation*; adherents have a reason[13] for *selecting fit variations*; and evangelic

[13] Avoiding burning in hell or at the stake for example

spreaders of the "good news" provide a vehicle for *replicating and transmitting selected variants.*

4.3

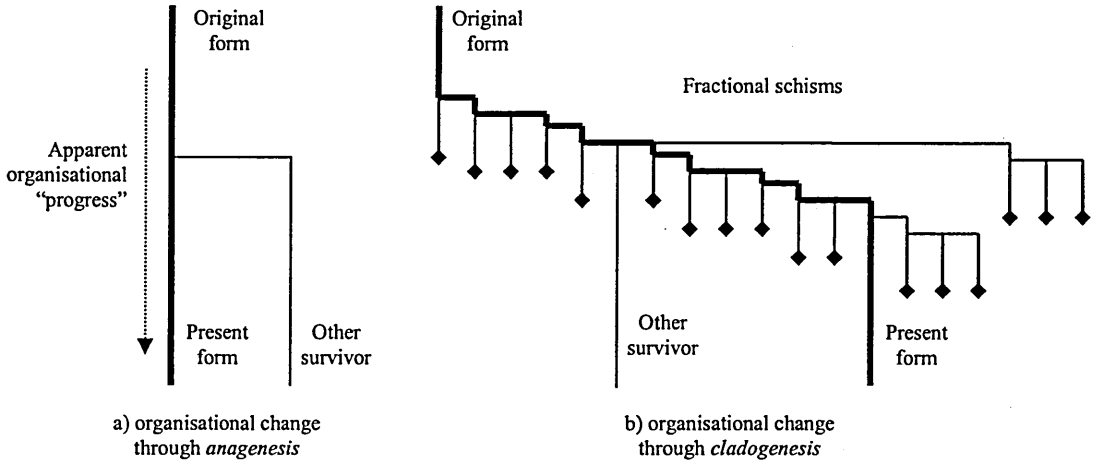

Figure 4-5. Two evolutionary models of organisational change

Future research

> However, meme theory is developed enough to be operationalised conservatively by adopting what could reasonably be called a memetic stance ... Whether the memetic stance turns out to be an explanatory device in an evolutionary extension of folk psychology, or a proper theory of mind where memes are internally instantiated in the neural networks of our brains is an issue that will one day have to be resolved empirically ... By integrating social contagion research and the memetic paradigm we would allow for the development a robust body of theoretically informed empirical research. In doing this we will be laying one more foundation for the long overdue Kuhnian paradigm shift that will finally see the integration of social science within a broader evolutionary paradigm. – [Marsden, 1998]

Overtly the research agenda was with demonstrating a sound methodology that would contribute towards showing the presence of an organisational gene. More interestingly though, are the avenues of research that are now opening up: methodology refinement, more sophisticated implementation and application to other organisational forms.

4.3.1 Methodological re-development

In light of the pilot's results it is clear that there is considerable room for improvement in the method and the methodology. As both phenetic and genealogical algorithms were fairly solid, then many of the improvements are around data gathering. The weak point however, was the final comparison stage that needs considerable attention.

4.3.1.1 Improving phylogenealogy

Other than improving the quality of data capture using complementary techniques, the phylogenealogical method can be improved in two ways. Firstly the method was rudimentary, only considering the base case of a single parent. Organisation may have multiple "parentage", through mergers (Vos & Keller, 2001) in the Methodist cluster or perhaps as an analogue of Lamarkianism (acquisition of characters). Consequently, enhancing the phylogenealogical method to accommodate more sophisticated lineages would give it a more general application.

Secondly, MENDEL was limited in its production of phylograms. The software could be enhanced, not only to handle multiple parentage, but also to perform "rotations" (Appendix A) whereby different structural orders can be generated.

4.3.1.2 Improving phenetics and meme mapping

Phenetics requires improved data quality even more so than the phylogenealogical iteration as the state of each new character has to be established for every religious body. Ideally, instead of axing "meaningless" characters, each one should count. Rather than relying on narrative contaminated by essentialism, primary research might be conducted by questioning at least one authority within each organisation in the sample. Of course, some characters might be controversial but this can be taken as a character state (which has potential for schism). A "two pass" methodology might be used: first to discover and select relevant characters then second to establish their states.

Phenetic reconstruction could also benefit from improved software. The plethora of association and clustering options becomes a problem with phenetics (see 4.3.2). Although, in using relative matching, other options are unlikely to have significant influence on results, experimenting with various alternatives might suggest refinements.

The meme mapping took the simplest format of *binary encoded meme strips* that depicted the qualitative presence or absence of a trait. Other encoding formats are possible such as numeric quantitative or symbolic encoding. It may be possible using more advanced formats to encode directly from narrative using similar methods as *lexical phenomenography* (Lissack, *s.d.*)[i]

As with the phylograms, enhancing the software so that it can perform "rotations" would be a considerable help in understanding the results.

4.3.1.3 Implementing a metric and method of dendrogram congruence

As the bugbear of the entire research effort, dendrogram congruence requires the most attention. In the first instance, the notion of a match needs to be better understood in terms of what the trees actually represent and also from the abstract mathematical perspective. Moreover, an objective scalar measure of both direct and relative matching, along with the combinatorial significance, of at measure could be determined. Interestingly, the starting point for this metric may lie in phenetics.

Manual comparison didn't only restrict experimentation with other association or clustering strategies but also concealed the falsehood of the positive result. The metric would not only provide confidence values but also provide a platform upon which a rigorous method can be constructed; this algorithm could then be implemented in software. Along with the potential improvements to the phylogenealogical and phenetic iterations, the matching system could be used to explore different options and rotations of the trees.

4.3.2 Future software tools: MENDEL and EDEN-ML

The software was specified with an upgrade path in mind in order to accommodate more advanced analysis and greater flexibility. Some of the method specific improvements have been suggested above (§4.3.1); potential developments slightly outside the research are considered there.

4.3.2.1 Implementation of other association and clustering strategies

Many variations for phenetics have been described by Sneath and Sokal (1973); only Hamming distance and UPGMA have been implemented for reasons given in part 2. It is intended to allow MENDEL to access other association coefficients and clustering strategies. Using an EDEN-ML, enhanced to simulate more sophisticated evolutionary scenarios, along with a reliable metric of tree similarity (also implemented as software), it would become possible to compare accuracy of the other options available.

Appendix M discusses experimental simulations of reweighing the "bishop meme" which affected the phenogram structure at the macro level; it was hypothesised that other characters were sensitive to the Episcopacy. Current limitations prevented further weightings experimentation. Future development might involve character weighing, which may reveal the "canonical memes" that cement the tree's structure[14]. This may lead to predictive models accompanying character emphasis change within an industry sector.

[14] they may become known as keystones, fulcra, horseshoe nails or something else

4.3.2.2 *Internet methodologies*

MENDEL was designed around the object paradigm and this enables its reuse in other compatible applications. This flexibility allows it to be used in conjunction with the Internet that would allow for interactive questionnaires. Automated global data capture would become feasible in two ways:

1. Recipients could access and respond to questions via a web page, this data could be captured, stored, and processed on the ISPs server.
2. Bots can be created to data mine the Internet and return relevant information to the database (data mining is heavily based on cluster analysis techniques).

4.3.2.3 *Landscape analysis*

Another proposed expansion is to enable the software to perform landscape analysis by scanning meme strips to establish fitness peaks and the evolutionary pathways by which they are accessed. An important aspect of this is the ability to spot path dependence and unpopulated peaks thereby anticipating organisational straitjackets or new abiotic forms. By "terrain crawling", the software should be able to calculate the optimal path to reach higher peaks. Furthermore, to some extent, this will also offer some predictions as to the implications of making changes to meme states or reweighing them. Such would have potential as a strategic tool.

4.3.3 *Other potential fields of investigation*

The following are suggestions for potential investigation using aspects of the the research method.

4.3.3.1 *Further investigation into faith*

Religious phylogeny and phenetics are interesting topics in their own right and a more complete and accurate investigation would complement the study of comparative religion. Christian denominations and sub-sects that were precluded from this study could be incorporated within an extended study, along with eastern branches and possibly Jewish and Islamic sects. Melton (1996) provides an extensive list of candidate taxa while more characters could be investigated as per Sawyer's (1999) taxonomic charts (forming a "Global catechism"). Complementary research methods that yield primary data (ie. ethnomethodology, interviews, questionnaires etc.) could be employed. Such an undertaking would provide a map that would be useful not only

to social scientists, historians, and students of comparative religion but also to seminarians and theological scholars.

4.3.3.2 Facilities Management

A contemporary research initiative is investigating aspects of Facilities Management (Lunn, in preparation) with the hypothesis that the FM market in the UK is emerging as a complex adaptive system and displaying evolutionary properties. This parallel research effort not only afforded an extensive second commercial data set by which to apply the method but in return the present research offered a tool for examining evolutionary properties of the FM market.

MENDEL processed a data set of the FM market; the result was consistent with the hypothesis that markets have a tendency (driven by self-replicating schemata or memeplexes) to self organize toward stability, or at least the illusion of stability (Full details in Lord, Lunn, Price & Stephenson, 2002 in Appendix I). The FM test demonstrated "real world" applications for the present research and its potential as a tool for strategic analysis.

4.3.3.3 Literature analysis

Pinder's (in preparation) review of building obsolescence literature produced a characterisation of the viewpoints of various authorities, which was fed through MENDEL (Fig. 4-6).

Outside its facilities management application, the research is interesting for two reasons. Firstly, from the memetic stance, it shows a range of competing architectural[15] *explanemes* by various authorities. Interestingly though, the subject is *obsolescence* which may be considered as "anti-fashion" whereby authors are attempting to promote certain *selectemes* that ultimately manifest within the built environment. Secondly, and content apart, Pinder introduces a methodology for literature review. As Dennett (1995) poetically expressed '*a scholar is a libraries way of making another library*'; so developmental history (who reads whom) contributes to a field's understanding. It would be quite an undertaking, but it should be possible,

[15] "Ways of building arches" as Dawkins puts it

to measure congruence of the phenogram against a genealogy of citations. Practically however, phenetic classification highlights the main schools of thought, who is "out on a limb" and what the main bones of contention are. The application of methodology to literature review, along with proposed extensions to the MENDEL software, will also be able to forecast the direction of a field of inquiry along with identifying critical gaps in knowledge for research purposes.

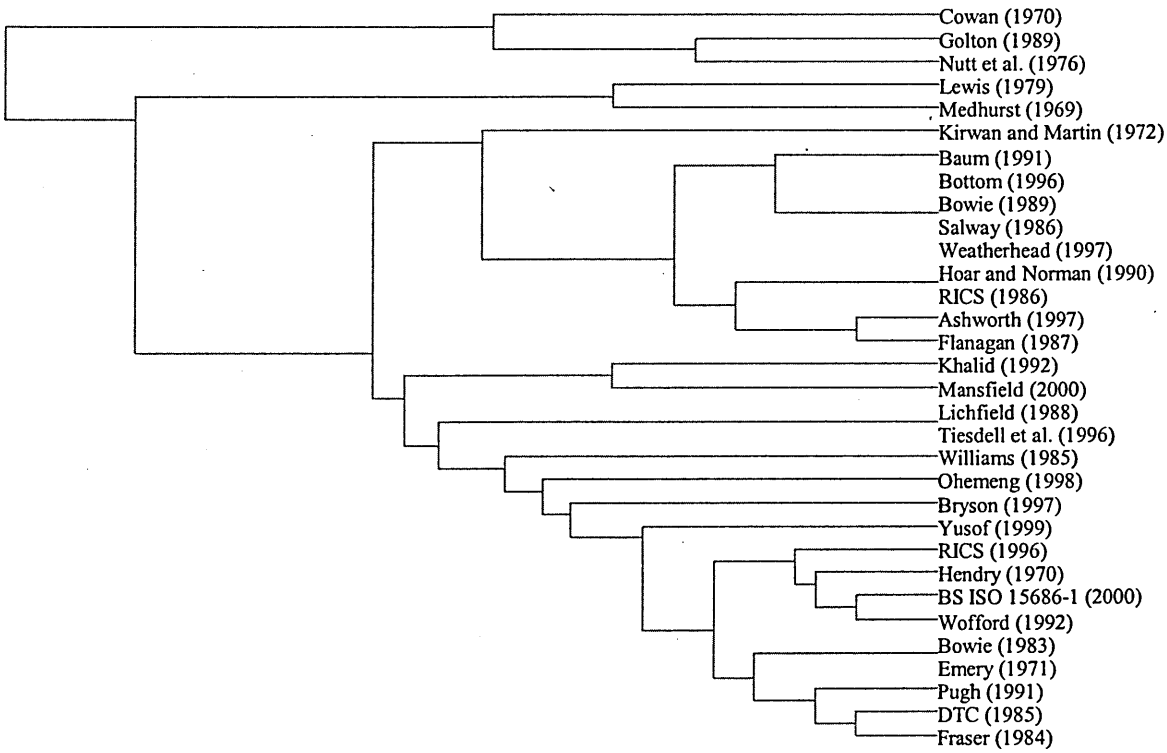

Figure 4-6. Pinder's phenetic classification of authorities on building obsolescence

4.3.3.4 Venture capital funding preferences

Another test (performed by the researcher) was to take a matrix of venture capital firms and their funding preferences taken from venture capital report, to form a phenogram of investment. This might be useful for identifying funding trends.

4.3.3.5 Other topics for investigation

The selection criteria for the test group provided a list of candidates (§3.2.1). These candidates may also be the targets for more applied future research.

- Business fashions/fads
- Professional bodies
- Kung-Fu and martial art styles

- Manufacturing technology
- Political ideology

4.3.4 Speculative organisational application

While the research and the test case were academic, there are practical applications for organisational development in commercial enterprises and the auxiliary test on key FM players provided a first trial. It is anticipated that the theme of organisational memetics will bridge the gap between academic memeticists and practitioners, managers or consultants in industry.

In accordance with Dawkins' (1976) rebelliousness, Price and Shaw (1998) have noted the effects of pathogenic selfishness of memes on organisations and have controversially conjectured[16] that we uniquely have a 5th attribute of *pattern shifting leadership* that allows us to *'also grow beyond our cultural inheritance'* (*ibid,* p313). The upshot of this attribute is that memetics can offer viable solutions to previously intractable organisational problems: the very thing that those at the "coal face" hanker for. Part one of this volume however, was wary of modernity, progressivism, Cartesian dualism and related ideals that have permeated management thinking. The question then becomes, how can the results of this research be used to develop practical tools and techniques for organisational change without falling into the same old trap? Price and Shaw (1998) point out the essential difference:

> In the self-organising world, the role of the 'manager' is not so much to specify and control the activities carried out by a company as it is to interpret, and rearrange when needed, the patterns that produce a given mode of self-organisation. We hear much about the challenge of managing change – but the more profound challenge is *growing the capacity for the organisation to change itself.* – [Price & Shaw, 1988 p315]

The shift in perception from organisation as mindless mechanical appliance to that of autonomous living entity[17] is pivotal to applied organisational memetics and should be borne in mind with the following tentative suggestions.

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[16] the principle of organisational memetics was described in §1.2.4 while the controversy of rebellion in §1.2.3.3.5

[17] A familiar theme in science fiction explored in Capek's RUR, Huxley's Brave New World and later in both Blade Runner and with Star Trek's commander Data.

4.3.4.1 *Commercial tooling*

Price and Shaw (1998) have prescribed several facilitative methods of pattern shifting in organisations. Here however, are applications that stem directly from the method and are concerned mainly with memetic analysis and strategic formulation. It is at this point that MENDEL and EDEN-ML attain their true potential as, with modification, they can be made into tools for organisational development (also §2.3.3).

Marketing and business strategy (Porter, 1980) have classically considered various opportunity frameworks for predicting environmental conditions and proactively steering the organisation towards optimal conditions (Whittington, 1993). The most obvious application of memetics (ignoring philosophical contradictions) lies within the classical mode. For example, a market landscape is a map that shows where an organisation is positioned, where its competitors are, where it needs to be, and (sometimes) the route to take. Phenetics and phylogenealogy provide meme maps of character evolution within a commercial sector. Routes of descent and memetic lock in could be identified along with strategic "green fields" and other landscape features[18]. The ability to see the direction of "evolutions arrow" of markets, fashions and technologies would indeed confer a strategic competitive advantage. The test of FM landscape (Lord et. al., 2002) gave some indication of the method's potential.

4.3.4.2 *Application areas*

There are many potential sectors that may benefit from operationalising memetic ideas and the following are just some examples

- *Organisational change*: Both public and private sector organisations are memetically laden and would gain from "weeding" out parasitical memes.
- *Marketing*: Commercial organisations particularly need to proselytise their message through the expensive medium of advertising[19]. New approaches such as viral, referral or guerrilla marketing make explicit use of existing cultural channels and could be accelerated though science and some memetic priming.
- *Education and health*: It is possible that pathological memes such as suicide contagion (Marsden, 2001) and smoking (the world largest preventable cause

[18] These concepts are part of MENDEL's proposed abilities.
[19] Which Lord Leverhulme underestimated to be half wasted

of death) are truly *viruses of the mind.* The same vectors may be employed in releasing benign strains thereby enabling contagious "inoculation". Aphorisms such as '*coughs and sneezes spread diseases*' or public service announcements such as '*don't die of ignorance*' act as a firebreak against biotic disease. Memetics may be used as a way of engineering such memes for purpose[20].

4.4 Personal reflections

"Isn't it interesting that the same people who laugh at science fiction listen to weather forecasts and economists?"

Kelvin Throop III

Memetic research. What would drive anyone to cloister themselves so long? I think that I should at least attempt to justify my actions. At least this reflection process will be cathartic if nothing else. Here, I am going to take the liberty of expressing my more subjective thoughts (while relaxing the academic style).

4.4.1 How I got into this (abridged version)

As a child I saw Stanley Kubrick's 2001 *a space odyssey* (and Arthur C. Clark's novelisation) which provided a foundational fascination with evolution and cognition as well as science fiction. In the early nineties as a computing student my wellsprings of inspiration became *Analog* and *Asimov* periodicals, which drew me to AI, nano-technological recursive neural architecture and iconic data structures (and stuff!). Both of these publications are monthly magazines devoted to both actual science and speculative science fiction. They are carefully considered extrapolations, detailed thought experiments[21], by imaginative practicing scientists and academics, about the consequences of tomorrow's technologies and discoveries.

My first conscious awareness of the word *meme* was in a disturbing Novelette by Norman Spinrad called *What Eats You?* (Asimov Magazine, June 1991 pp54-72). This unpleasant story hangs around technology for encoding specified memes onto biological viruses in such a way that human personalities can be modified in exacting

[20] The ethical considerations are enormous, some of which will be acknowledged in Appendix J
[21] Rather than the "blue meanies from mars" or the "soap opera on a spaceship" genre.

ways for nefarious purposes – but superficially for recreation. LAPD's bio-narcotics division are called upon to resolve a grizzly situation that ensues when a military meme falls (inevitably) into the wrong kind of hands. The meaning of 'meme' had to be taken from context, as it remained undefined while, at the time, I assumed that it was neologism exclusive to the story.

My second run in with the meme was, once again, through science fiction with a rereading of Michael F. Flynn's *A Rose by Other Name*[22] (Analog, May 1990 pp110-157). Set against a backdrop of factual historical events and plausible scientific terminology the plot centres on a property developer who accidentally stumbles across a hidden society that has been secretly calculating and directing the course of history for more than a century and a half. Their methods of "adjusting" culture involved engineering memes that encourage or discourage patterns that benefited the *Babbage society.* At this point the word meme, for me, began to take on some kind of meaning although its implications I would not know until much later.

My undergraduate course introduced me to organisational studies, which I saw as "unscientific", and singularly failed to capture my interest. One assignment question was:

> Explain the two alternatives views regarding the role of management in dealing with the environment (Natural selection or Strategic management). Based on your own views and experience tell which one is the most realistic.

My perspective on organisational natural selection[23] was literal, which prompted the examiner to comment '*An analogy is a vehicle for understanding; yet it clouds understanding if taken too far*'. Luckily managing to get a deferral in that module meant that I had all summer to develop a curiosity and interest into how organisations behave. However, I still didn't agree with the examiner and wanted to re-emphasise Darwinian thinking. At BSc final year project level, I began to make connection between memes and organisational evolution and at MSc, the evolution of management information systems was becoming clear to me. Admittedly, although my ideas may not have been well presented, they were certainly ill received.

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[22] This article, for marketing purposes, was abstracted from a more detailed novel *In The Country Of The Blind* (Flynn, 1990).

[23] I tentatively invented the term "Industrial-Lamarckism" which curiously, in the memetic light, makes more sense now than it did back then.

The grain of an idea of doing some kind of PhD[24] vaguely in memetics had been lodged in my mind since the early 1990s. Having found almost nothing published on the subject I pursued my conjectures in total isolation. My ideas considered the meme to be a pathogen of organisational culture and thereby suggested "therapeutic" consultancy interventions; I aimed to develop practical techniques for organisational change[25]. It was during the final stages of my MSc that I found free access to the Internet, which had, to my surprise, numerous pages on memes and some of them were serious. Moreover, one author was writing about co-operative evolution and *organisational memetics* and, to my even greater surprise, If Price was a professor[26] at Sheffield Hallam University.

4.4.2 On doing a PhD

Perhaps the best way to approach a description of doing the PhD would be to provide a chronology of the phases it went through noting to positive points, things that could have been done better and cautionary tails picked up along the way.

4.4.2.1 The beginning

4.4.2.1.1 The first year: wondering what to do

Owing to the serendipitous and opportunistic origin of the research, I was not entering into an existing research program with a clear and well defined research agenda; just a vague notion about memes and a hunch that they may be connected in some not immediately obvious way with organisations. The effort was enthusiasm, rather than goal, directed. Activity revolved around general reading of all things memetic; looking at obvious mechanisms of spread such as cults, brainwashing, religion, network marketing and so on; and trying to formulate some questions.

Although I was fairly convinced that the research would be a hunt for the organisational gene, a few research possibilities were pursued for a while:

- Epidemiological study of Methodism during industrialisation in the Manchester basin based upon historical archives.

[24] To overcompensate for previous educational sub-normality brought about by a failed ITA experiment conducted in the 1970s.
[25] I had coined the idea RME (Appendix J) within my first (rejected) BSc dissertation.

- Using lexical phenomenography (Lissac, *s.d.*) on e-mails to trace meme diffusion.
- Considering *unwritten rules of the game* (Scott-Morgan, 1994) within South Yorkshire police or Royal Mail's culture from the memetic stance.

The most promising however (being based at the Facilities Management Graduate Centre) appeared to be investigating the evolution of professional bodies: BIFM, RICS and other built environment professions.

4.4.2.1.2 Getting an idea

The idea that eventually formed the research methodology came from my director of studies' (If Price) connection with the manufacturing complexity network and Ian McCarthy at the University of Sheffield[27]. McCarthy's organisational cladistics had produced reconstructions of the evolution of vehicle manufacturing technology although he hadn't considered a replicating substrate. The notion then was that Cladistics could be translated into the social sciences for tracing memetic lineages.

With some elaboration the RF1 research proposal was formulated. The objective was to reconstruct the memetic evolution and descent of professional bodies through cladistic methods. First however, as the method's application was uncertain, it was to be validated against a pilot group of known descent: religious bodies.

4.4.2.1.3 Initial research

The first step then was to attempt to see if a known descent could be constructed for a small set of religious bodies and this became the precursor to the phylogenealogical method (described in part 2). Although the preliminary manual constructions were promising, the overwhelming scope of the exercise and data available rapidly became apparent. At this point, a simple MS Access database was written that was capable of storing end taxa and characters as well as drawing rudimentary trees[28]. At the same time a very basic characterisation of religious bodies was attempted.

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[26] At the time visiting lecturer
[27] before moving down to Warwick
[28] The loss of this database in the university's system precipitated the full development of MENDEL

At the time I was unaware of a methodological confusion that I was making. The process became less clear the more I tried to understand cladistic literature and so I decided to ignore it and returned to first principles of developing the method for myself from scratch. Again this turned out to be a less than trivial task and ideas such as the 'h', 'Y' and 'λ' (Appendix A) hamming distance metric (Appendix B) were developed (later these became significant premises in the development of MENDEL and EDEN-ML).

I had reached a sticking point in my research; ironically the solution was at the bottom of a whisky glass. I did much creative thinking over a pint or two the local pub and would try to establish trees between how bottles were arranged in the refrigerators[29]. At the same time there was the Classic Malts whisky promotion that had a display designed to inspire comparative tasting. I had been trawling the Internet for ideas on cluster analysis at which point Lapointe and Legendre's (1993) paper, *A Classification of Pure Malt Scotch Whiskies* caught my eye. This event was significant in that it highlighted the inappropriateness of cladistics thereby suggesting a review of methodological assumptions; it reassured me of how close my techniques were thereby pointing to their refinement; and provided raw test data in Excel format which further encouraged the implementation of phenetic software algorithms.

4.4.2.2 The middle

4.4.2.2.1 Change of methodology and program

Even before the whiskey revelation it was becoming apparent that changes were needed in the research program. Firstly, as inadequacies in the initial methodology began to surface, the true nature of the research started to come into focus. It became clear that the objective was to *demonstrate the presence of a mechanism of inheritance* as opposed to reconstructing descent by an *assumed* mechanism of inheritance. Cladistics assumed *a priori* that which the research was attempting to test thereby invalidating that method. Phenetics, on the other hand, does not assume phylogeny and is therefore fully independent of the phylogenealogy.

Secondly, it was rapidly becoming apparent that there was insufficient time to do a comprehensive job of both religious and professional bodies and, in light of the shift

in methodology, nor was it necessary to cover both. Consequently what was initially proposed as the pilot was expanded to become the study.

4.4.2.2.2 MENDEL

The loss of the access version of the software, the availability of the whiskey data and the complexity of the task (along with other criteria in Appendix C) provided the impetus for the development of software that would become known as MENDEL. An initial prototype was finalised in time for demonstration at the manufacturing complexity network conference at Warwick 2000 thereby forming the backbone of the MENDEL specification.

Software is based on a kind of Fordism, the cost of each iteration of a repetitive task is reduced by putting effort into the initial set-up. A trade off has to be made between investment in automation and the number of times a process is used. I already had the experience of converting someone else's PhD research into a software tool. It occurred to me that the research didn't have to be a one-off disposable route to a certificate but rather that the process was reusable especially in light of the proposed applications (§4.4). Emphasis was placed on developing custom software as opposed to kluging existing applications. Much work was put into the testing stage.

4.4.2.2.3 Filling in the data generating results

Data entry was eased by the system design; actually getting the character states for each religious body turned out to be an arduous trawl with each datum taking up to several hours to establish or infer. Actually generating results, though use of MENDEL was quick and easy although additional functionality would have alleviated some of the manual work – it was this ease that allowed the weighting simulations on the Episcopalian trait.

4.4.2.2.4 The write up

The overall structure of the write up had been planned well in advance and an early attempt had been made in producing various sections just to see how they would pan out; much of the methodology section had been attempted. The final write up began in

[29] and subject these trees to "peer" review – interestingly, it could be argued that bottle/drink styles are products of descent and their shelving arrangement does represent their memetic evolution.

earnest about eight months before suggested submission and was done according to a project plan. Unfortunately an episode of clinical depression[30] cost me over year a year.

4.4.3 So what?

Perhaps there are more *extra logical influences* behind my desire to obtain the qualification of PhD than I care to admit. At the same time, my quest for a memetic method was consuming. An exclusive choice of one would have made life much easier although it would have been unlikely that I would have embarked upon, let alone completed either course of action. Despite the conflicting goals, I wanted an interesting and useable PhD even if was going to take longer and be much tougher. In hindsight, would I have done anything differently? There are two things that I would have changed: the uncertainty caused through the unavailability of an established research template, the time taken to resolve that issue and the frustration of submission and funding deadlines.

Perhaps, and importantly, I should have devoted much more time to becoming very clear about exactly what I wanted and why. Also understanding the philosophy behind the PhD degree would have helped me to attempt a more considered choice. I could have taken a more pedestrian path with a predefined objective and methodology and have had the research completed three years earlier thereby giving me the licence to pursue my own interests. I don't honestly think such rationalisation would have made one iota of difference as the novelty of the subject and the nature of the opportunity meant that the research program would have to develop as it went along. I do believe however that the resulting program was over ambitious and demanded too many novel contributions along the way.

One way I could have cut the time down would have been to study the methodology literature at an earlier stage rather than trying to construct the idea from first principles. Figuring the puzzle of phenetics out for myself was engrossing and provided a profound insight into both the underlying principles of taxonomy and what I was really trying to achieve. An in depth understanding of the methods wasn't

[30] Sufficient enough to make Midgley's (1979) nightmare a reality.

strictly necessary - simply pushing the data though a relevant piece of off-the-shelf software would have produced similar usable results.

The development of MENDEL was also time consuming (an underestimation on my part of the project's scope) and distracted from the core objective. Perhaps I should have been thinking solely of a PhD rather than its future expansion and application but utility was one of my goals for the research (see part 1). Again, development of the software afforded me a unique perception into the nuances of numerical taxonomy.

Maybe I should have taken the advice of my supervisors, teachers and others that I should avoid risking my PhD, to play it safe and just get the degree. It may be a personality flaw but I tend to sail close to the wind and to pursue ideas that engage *my* curiosity[31].

Obviously much was learned about memes, methods, organisations and religion but the more profound learning came ultimately through disillusionment. Once upon a time I held a "star trek" fantasy that research would be a pioneering adventure into the uncharted realms of the natural world, fraught with surprise and danger but eventually leading to a treasure chest of wonder. I now feel though, that much research is mechanical – factory work for the head - estranged from the quest of revealing nature's laws. Very narrow research objectives and a clear and well established methodology make it fairly straightforward to quantify resources and timescales involved – which might "suit the suits"[32] - but following established sheep tracks does not lead to finding new territory, it just gradually deepens the rut. If the indoctrination of *risk avoidance* at PhD level is likely to be hauled through a scientist's career, then are research degrees actually memetic canons acting to uphold the status quo and inhibit discovery?

4.4.4 Now what?

Its hardly a revelation but "academic" isn't "practical"! At heart I am an engineer – I ask, "How can I use this?" A scholarly approach to organisational memetics has been

[31] Usually invoking the anger and scorn of some authority
[32] or at least the memes of funding methodologies.

very entertaining but has it made any difference or has it been just part of a library's reproductive mechanism (Dennett, 1995). Similarly and cynically, I may ask whether the purpose of education is accruing debt in order to pay for education; either way I am now compelled to find ways of developing upon and utilising this knowledge.

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[i] http://lissack.com/writings/lexp.htm lexical phenomenography

Appendix A: Dendrograms

Dendrograms, the graphical representation of trees, have been important throughout taxonomy in general and this research in particular. This appendix makes explicit certain assumptions and methods involving trees.

A.1 Graph theory

Arboreal morphs have a more abstract mathematical analogue found in graph theory (Carré, 1979; Wilson, 1973)[i]. Concepts in graph theory enabled genealogical and phenetic iterations of the methodology to be defined and modelled as data object within the MENDEL software (Appendix C). Some important concepts (with relation to the current research) are:

- A *vertex* (Node) is an item, group, individual or species usually depicted by a box or a circle. An *edge* (Link) is the relationships between nodes (eg descent in a phylogram) generally depicted by an arrow within a *directed* graph (digraph) or a line (no arrows) in a non-digraph[1].
- A *graph* is a set of vertices *v* and a set of edges *e* such that *G=(v, e)*. A graph is *connected* where there is a *chain* of links between any two vertices. A cycle is where more than one *chain* exists between any two vertices.
- A *tree* is a cycle free connected graph that exhibits a branching structure and no node or groups of nodes are isolated. A *binary tree* has two *branches* at each *fork*.
- A *rooted tree* has a special node designated as the *root* and each of the nodes that is one edge further away from a given edge is called a *child*. Nodes connected to the same node are then called *siblings*.

Rooted trees can be used in phylogeny and genealogy to model the relationship of intra or inter specific descent, numerical taxonomy to model phenetics resemblance, and classification to model agglomerative hierarchies. Further, relationships of parent, ancestor and descendent etc. may be defined from the *child of* relationship.

---

[1] Whether a graph is a digraph or not depends upon the symmetry of the relation modelled. For example, sibling relationship is symmetric and would have no arrows, whereas parent-child would require an arrow to denote who was the parent of whom (i.e. form a digraph).

A.2 Types of dendrogram

Graphs and trees are abstract mathematical or data structures that can be depicted visually as a dendrogram. Different ways of drawing trees exist and have different applications.

A.2.1 Different means of representation

Although there are others, three forms of representation are covered here[2] – λ, *h* and *Y*. Although each has advantages and disadvantages, emphasise and inhibit certain information, and are suited a given systematic representation, they are topographically related[3]. Is should be noted that while the "vertical icicle plot" depiction has been chosen, it is possible to rotate or mirror dendrograms as is useful.

A.2.1.1 The 'λ' representation

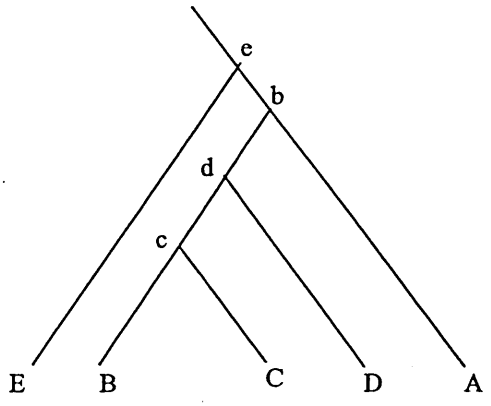

Figure A-1. The λ representation

The λ representation (Fig. A-1) consists of a bifurcating structure of diagonals starting with an initial line (i.e. A). This form of representation is particularly suited to representing phylogeny as a phylogram whereby the lines simply represent specie. It is easy to see, the pattern of descent, splitting events (eg *e*), ancestral relationships and clusters. Further, it is possible to represent time along the vertical axis.

[2] I introduce this terminology to reflect the general shapes that the graphs make.
[3] I have attempted to express the transformation rules between representations as this would assist in establishing congruence between the phylogram and phenogram in the research method (§2.5.5). However, the problem was non-trivial and beyond the scope of research. Establishing transformation rules and a metric of tree congruence is proposed for future research.

Such dendrograms are tedious to draw and clumsy to modify manually but unfortunately also difficult to specify for automation. Further, they tend to require large areas to depict.

A.2.1.2 The 'h' representation

A variation on the λ is the h representation (Fig. A-2), which starts with a vertical line and bifurcates in "steps". Again, a phylogram is a suitable application. This representation is comparatively easy to draw manually, specify for automation and takes up less space. It also preserves the temporal aspect of species and their splitting. Unfortunately the horizontal lines make the pattern of descent less clear.

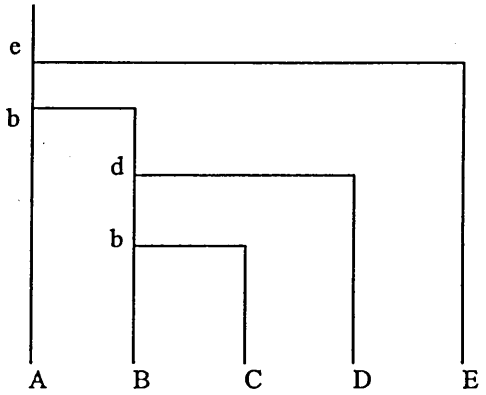

Figure A-2. The h representation

Another advantage to the *h* representation is that it can be compressed into a simpler diagram by losing the temporal aspect and just preserving the phylogeny (Fig. A-3).

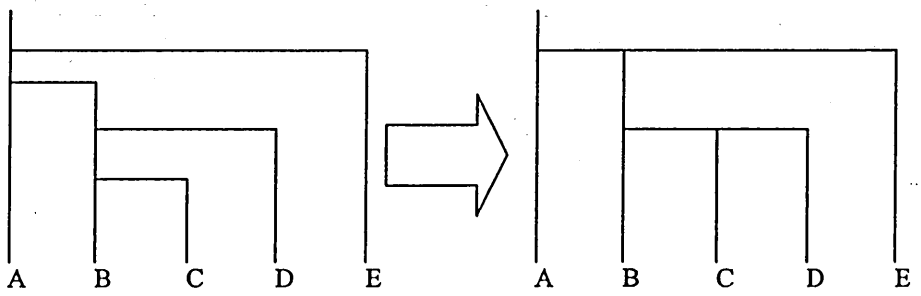

Figure A-3. Simplification of the h representation

A.2.1.3 The 'Y' representation

A third representation (Fig. A-4) consists of a binary tree (though *n*-ary variations may be depicted) which is a bifurcating cascade. Again, the *Y* representation is topographically related to the λ and *h* forms (c.f. their labels in figs. A-1, A-2 and A-4). However, this form of dendrogram is better suited to being a phenogram than a

phylogram as it provides a better portrayal of proximity than of phylogeny. Indeed such plots are conventional within numerical taxonomy and the height of the horizontal bars are representative of phenetic resemblance (Sneath & Sokal, 1973).

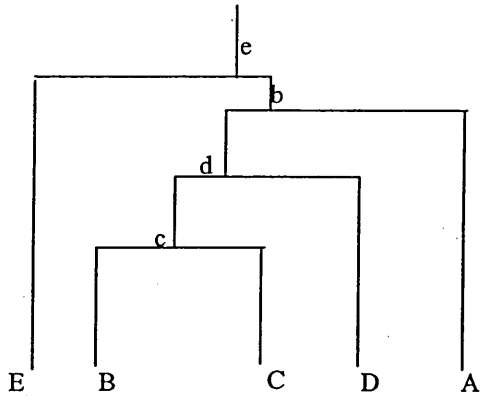

Figure A-4. The Y representation

A.2.2 Additional notation

Reconstructing organisational phylogeny from historical data using genealogical methods required the use of compressed *h* representations and the use of certain additional symbolism to depict significant contributory events. Figure A-5 provides an example of potential evolutionary events (which were encountered in the reconstruction of Christian denominations). The root *P* (no found parent), is the parent of *Q* and *R*, which later merged to form *U*. Before this merger occurred, *R* itself split into S (now extinct and depicted by the diamond) and *T* (extant). The down arrow on *U* (fig. A-5a) denotes that the lineage is continued on another diagram (fig. A-5b) and *visa versa*. Extinctions and mergers are only however, useful for understanding history. The composite diagram is required to depict only the phylogeny of extant taxa (Fig. A-5c)

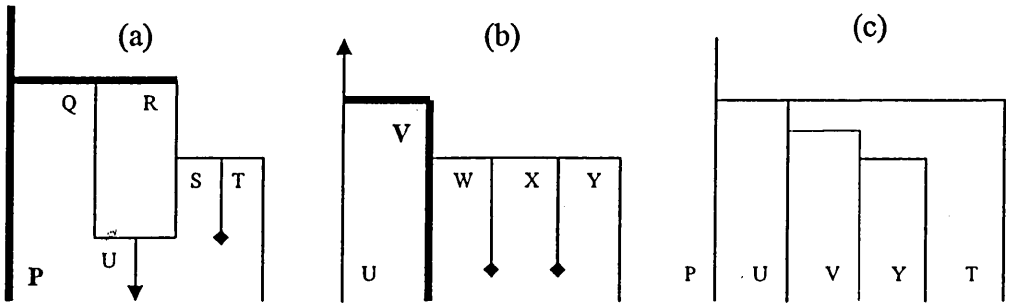

Figure A-5. Example of notation

A.3 Reconstructing phylogeny

A.3.1 Genealogical data

A phylogeny can be modelled through a cycle free connected graph with a designated root vertex. A graph G is defined as (Carré, 1979; Wilson, 1973 etc.):

$$G = (v, e), \text{ where with vertices } v, \text{ and edges } e \subseteq v \times v$$

The vertices represent the taxa and the edges the pattern of descent between parent and child (species). In a rooted tree while a parent may have any number of children, apart from the root, each node must have one and only one parent[4], which must exist within the set of taxa. Hence each taxon t, other than a single root, has one edge to its parent p_t that is of the ordered pair form (t, p_t). It is possible then, subject to terms and conditions[5], to specify a phylogenic tree simply using a two-column table whereby *taxon* is the key field and each tupple represents an edge[6].

Here a simple manual example of how to reconstruct phylogeny using genealogical methods is presented. The first step is to uniquely identify the taxa, which are placed in a table (table A-1).

Taxon
A
B
C
D
E

Table A-1. Unique taxa list

Taxon	Parent
A	B
B	
C	A
D	B
E	A

Table A-2. Parent taxa identified

Analysis of historical data should reveal the parent (existing in the original list) of all but one taxon. In the example (Table A-2) taxon B has no parent and therefore is the root.

---

[4] Genealogical trees of sexual reproduction or cladistic phylogenic assumptions may imply other constraints on fan in and out.

[5] It is possible to formulate a precise mathematical definition using predicate calculus, however, such an exercise is beyond the intention of this report.

[6] Graph theory is directly connected to relational algebra upon which certain database structures are built and proved useful in the construction of MENDEL (Appendix C)

A.3.2 Phylogram reconstruction

A manual reconstruction example is presented. In practice when drawing these diagrams manually, they can become untidy and so may require redrawing[7]. Taxa order is logically irrelevant for phylogram reconstruction. Taking the taxa in the order that they are presented in table A-2 a phylogram is constructed thusly.

Taxon A - is drawn as a vertical line (fig. A-6a)

Taxon B - is the parent of the first *A* and so a slightly longer vertical line is drawn to the left. The top of the child *A* is linked to the midsection of the parent *B* (fig. A-6b).

Taxon C - having *A* as its parent, is drawn to the right of, slightly shorter than, and linked to *A* (fig. A-6c).

Taxon D - also has *B* as its parent and is thus a sibling to *A*. it is represented by a line the same length as (and connected by a bar to the top of) *A*, to the left of *C* (fig. A-6d).

Taxon E - is the sibling of *C* (and is constructed similarly to *D* in relation to *A*). Taxon *E* however, is placed between *C* and *D* (fig. A-6e).

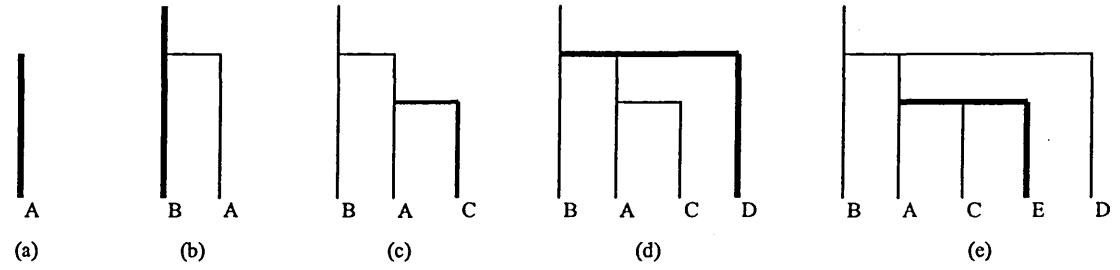

Figure A-6. Manual construction of phylogram

[7] An auxiliary feature of the MENDEL software (not described in the appendix) was to automate this construction by reuse of the NODETREE class module.

A.3.3 Amalgamation of trees

Large taxa sets may demand decomposition into familial groupings[8] for later amalgamation. Where parental direct lineage is not immediately clear then deeper investigation into mergers, takeovers and extinctions may be required in order to establish a final pattern. Using the example §A.2.2, firstly, mergers (i.e. *Q* & *R*) and extinct taxa (i.e. *S*, *W* & *X*) can be removed (Fig. A-7a_i & b_i) leaving the phylogeny of extant taxa (Fig. A-7ba_{ii} & b_{ii}). Branches of a phylogram leading to further phylogenies (i.e. *U*) may then be replaced with their sub-phylograms resulting in the composite tree (Fig. A-7c).

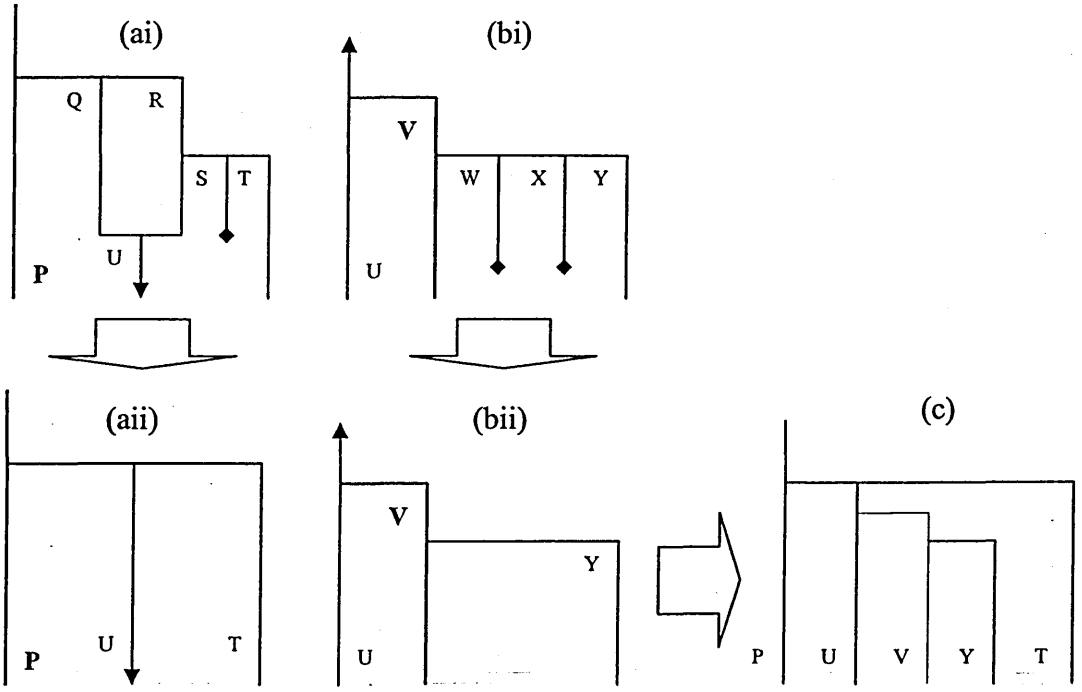

Figure A-7. Example of amalgamating trees

[8] As performed in the test in part 3 by separately reconstructing denominational families.

A.4 Transformations

Certain transformations are available on dendrograms such that branches can be swapped around while preserving the essence of the tree. This is very much like having a mobile made out of wire hangers and allowing them to rotate. We might consider each junction (of a binary tree) to be an axis of rotation whereupon two branches may be rotated (i.e. 180°) or not (i.e. 0°) as in Figure A-8. As each axis can either be rotated or not then we can calculate the number or transformations available as two to the power of the number of axis. Figure A-9 shows some of the possible variations on a more complex tree.

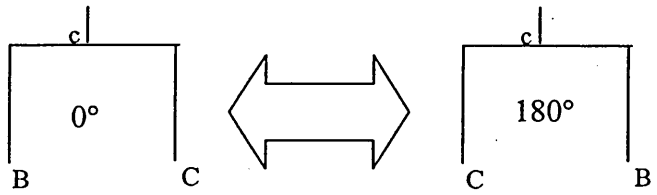

Figure A-8. Rotation about axis c

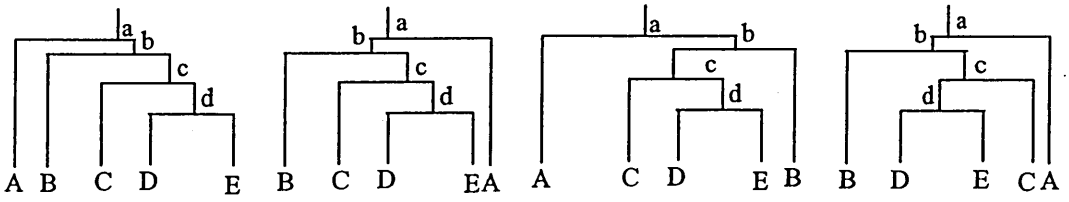

Figure A-9 Four of the sixteen possible transformations

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[i] http://people.hofstra.edu/geotrans/eng/ch2en/meth2en/ch2m1en.html provides definitions in graph theory; also Weisstein's world of maths http://mathworld.wolfram.com/topics/GraphTheory.html http://www.mills.edu/ACAD_INFO/MCS/CS/S00MCS125/Practical.Graph.Theory/terms.html

Appendix B Hamming distance

B.1 Fidelity metrics

B.1.1 Signal degeneration and digital error

Analogue signals, are highly prone to degradation and interference especially over extended distances[1] and their use in electronics requires low noise circuit design and high tolerance components. A digital signal, on the other hand may sustain a high degree of interference before becoming too ambiguous to reconstruct (Horowits & Hill, 1980). Shannon[2] (Shannon, 1948[i]; Shannon & Weaver, 1963), considered mathematical aspects of discrete noiseless communication and multimedia pulse code modulation (PCM).

Digital communication and processing however, is not without fault (e.g. power supply glitches, high baud[3] timing problems, climatic interference etc.) and various forward error correction coding algorithms (employing parity etc.) provide high fidelity bandwidth. The work of Hamming[ii] on error detection and correction is particularly relevant.

B.1.2 Hamming distance metric

B.1.2.1 Definition

Hamming distance is a measure of digital signal difference and is almost exclusively used in electronics.

> A measure of the difference between two messages, each consisting of a finite string of characters, expressed by the number of characters that need to be changed to obtain one from the other - [Principia Cybernetica Web, 1996[iii]]

Essentially a digital signal is a string of binary digits (*bits*) of Boolean values (*on* or *off*) which is generally represented either as a string of 0s and 1s or their hexadecimal equivalent. Hamming distance ($d_{Hamming}$ or H_d) then, is a comparison between two equal length[4] bit strings (s and t) that counts where the bits are different. The simplest

---

[1] Communication was vital in control of the British Empire and the importance and complexity of high fidelity communications is illustrated by the Cable & Wireless museum http://www.porthcurno.org.uk/

[2] Interestingly, Shannon's PhD was in theoretical genetics.

[3] Signal state changes per second

[4] The Levenshtein (or *edit*) distance is more sophisticated. It's defined for strings of arbitrary length

combination is between a pair of single bit strings (s and t) having combinations and resultant Hamming distance given in Table B-1.

s	t	$H_d(s, t)$
0	0	0
0	1	1
1	0	1
1	1	0

Table B-1. Hamming distance between two single bit strings

This is clearly a truth table describing the Boolean function of *exclusive-or (XOR)*. Hence to find the Hamming distance for longer strings then they are "XORed" together and the number of truths in the result is summed. For example:

```
s                0100 1011 1000 0011 (hex=4B83)
t                1110 0010 0011 1010 (hex=E23A)

XOR(s, t)        1010 1001 1011 1001          bit count = 9
```

B.1.2.2 Metric spaces and H_d properties

Clearly there is no difference between a string and itself hence,

$$H_d(s, s) = 0$$

And it is equidistant from s to t as it is in return.

$$H_d(s, t) = H_d(t, s)$$

The Boolean complement of a bit string s (denoted $\neg s$) simply flips all the 0s to 1s and visa versa, for example:

```
s                0100 1011 1000 0011 (hex=4B83)
¬s               1011 0100 0111 1100 (hex=B47C)
```

Thereby providing the length of a bit string as maximum difference.

$$H_d(s, \neg s) = \text{len}(s)$$

Hence $H_d(s, t)$ has the precondition that $H_d(s, \neg s) = H_d(t, \neg t)$ i.e. equal length

A further consideration is that where two strings are close and a third string is dissimilar to one of those, and then it is dissimilar to both. By way of example consider three strings in figure Fig. B-1:

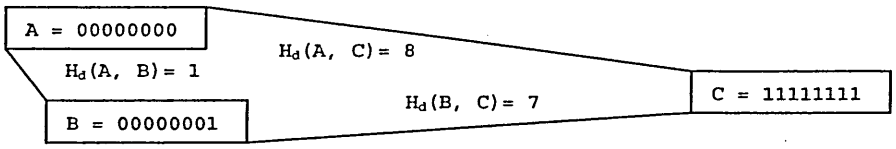

Figure B-1. Example of Hamming "trigonometry"

The Hamming distance is considered to be a discrete metric[iv] as *metric* is defined as[v]

> ... a nonnegative function $g(x,y)$ describing the "distance" between neighbouring points for a given set. A metric satisfies the
>
> | | |
> |---|---|
> | triangle inequality | $g(x, y) + g(y, z) \geq g(x, z)$ |
> | and is symmetric, so | $g(x, y) = g(y, x)$ |
> | A metric also satisfies | $g(x, x) = 0$ iff $x = y$. |

B.1.2.3 Hamming distance & coefficients of resemblance

The Hamming distance provides an *absolute* measure of dissimilarity between to bit strings. It is possible also to define Hamming similarity H_s as either

$H_s(s, t) = \text{len}(s) - H_d(s, t)$ based on the string length or,

$H_s(s, t) = H_d(s, \neg t)$ using the Boolean complement ($\neg$)

Alternatively it is possible to make comparisons by coefficients whereupon the difference or similarity is taken as a ratio to the length of the bit string.

$D_{SM} = H_d(s, t) / \text{len}(s)$ simple coefficient of dissimilarity

$S_{SM} = H_d(s, \neg t) / \text{len}(s)$ simple matching coefficient of similarity

A conventional measure of fidelity is signal-to-noise (S/N) ratio, which is measured in decibels. This measure is used particularly for audio fidelity (Chamberlin, 1985) and although convertible would be too exotic for the current application.

The simple matching coefficient is related directly to numerical taxonomy by Sneath and Sokal (1973) who also point out that coefficients of resemblance are metric (p120). Dress (1995) has examined Hamming & Levenshtein metrics as the mathematical basis for molecular phylogenetics[vi]

B.1.2.4 Function

Formally then H_d is a function from two equal length arrays of Boolean to Natural

$$H_d : B(N) \times B(N) \rightarrow N$$

The function is the summation where len(s) is the number of bits in string s, s_i is the i'th element of s and len(s) = len(t)

$$H_d(s,t) = \sum_{i=1}^{len(s)} \text{iif}(s_i \oplus t_i, 1, 0)$$

B.1.2.5 Algorithm and code

The algorithm for finding Hamming distance is straightforward:

```
Hamming Distance of String S and String T is found by:
      From the first to the last element of string S
            Compare elements of String S with T of equivalent
            position

            If they are different then increment the hamming distance
            count

      Move onto next element
```

And may be converted to code as the VBA segment exemplifies (from MENDEL)

```
Public Function HammingDistance(_
            StringA As Collection,_
            StringB As Collection)As Integer


      Dim ElementIndex As Integer
      For index = 1 To StringA.Count      'iterate through bits
            If StringA(ElementIndex) Xor StringB(ElementIndex) Then
                  'if bit set then increment HammingDistance
                  HammingDistance = HammingDistance + 1

            End If
      Next ElementIndex
End Function
```

Note that strings are actually implemented as collections for convenience of interfacing with the rest of MENDEL.

B.2 EMIT

A second consideration of this appendix is with evolutionary models of information transmission (EMIT) that considers copying error to be being a source of variation in the evolution of information. As most signals (including social transmission, as the meme-strip hypothesis asserted) can be binary encoded into bits strings.

B.2.1 Error distribution

Given that error is stochastic based on fidelity and there is an equal probability or change for any bit, then the probability that the copy will be a particular Hamming distance away follows the binomial distribution (Turner, 1970, noted also by Gabora, 1997).

$$(1-p)^{l-d}\, p^{d} \frac{l!}{l!(l-d)!}$$

where $l = \text{len}(s)$, $d = H_d(s, t)$ and p is the probability of error

Given sufficiently high fidelity (ie p is low) and a limited number of bits in the signal then minor glitches will be more frequent than major catastrophes. For example a 32 bit string a with p= 1:1000 the chances of incurring more than 1 error is negligible (Fig. B-2).

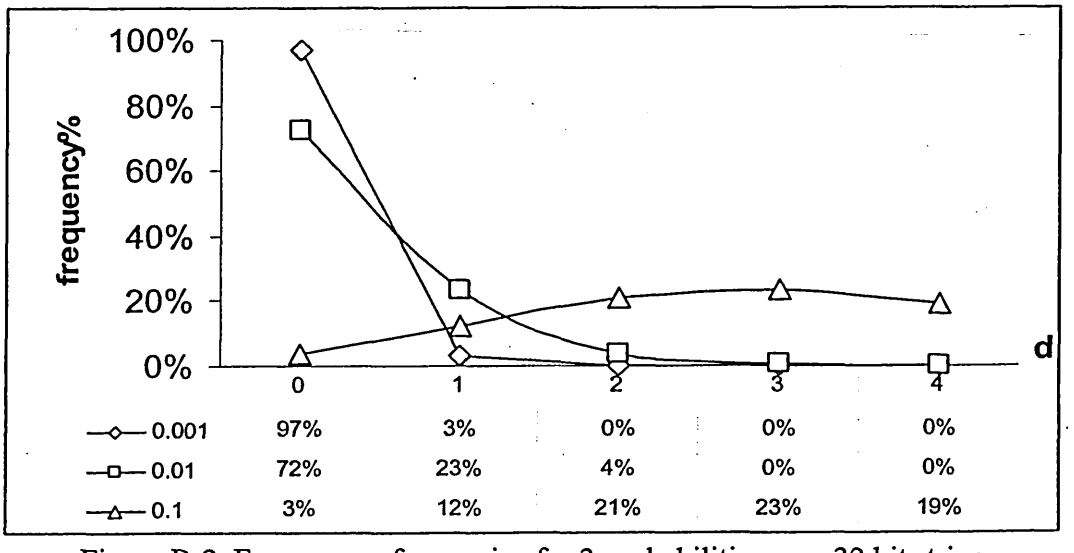

Figure B-2. Frequency of error size for 3 probabilities on a 32 bit string

B.2.2 Gray code and information variation

Where a pair of bit strings have a Hamming distance between them of 1 then they are said to be *adjacent*. A non-repeating series of adjacent binary strings constitute a *Gray code* (which corresponds to a *Hamiltonian path* across a Boolean *n*-dimensional *hypercube*). At least one Gray code can be established between any two binary strings of equal length. An example Gray code between two 3-bit strings (010 & 011) is shown in figure B-4 and traced as a Hamiltonian path traced across the edges of the 3D hypercube (Fig. B-3 – vertices are marked as (x, y, z) coordinates).

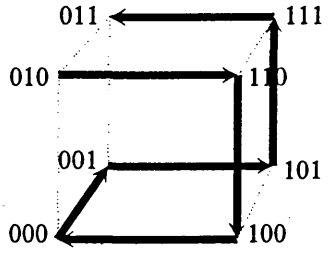

Figure B-3. Adjacent edges of hypercube

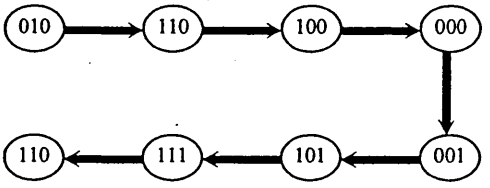

Figure B-4. A Hamiltonian path between two bit strings

Hence, even though minor errors are more frequent, it is possible that, where the signal is relayed in a chain, as with Chinese whispers, errors can accumulate causing severe erosion of the original signal (Fig. B-4). It may be argued then that digital signal variations (or degradations) are probably adjacent and are likely to follow a Gray code.

B.2.3 Information evolution

In terms of modern multimedia (sounds, images, animation and text) information transmission and storage is almost exclusively digital. Genetic transmission too, has analogues to digital encoding (i.e. 6 bits to define a codon).

> Shannon was the person who saw that the binary digit was the fundamental element in all of communication. That was really his discovery, and from it the whole communications revolution has sprung. - [R. G. Gallager, MIT[vii]].

Shannon's view suggests that all information may be discretely encoded[5] and transmitted (electronically or otherwise mediated). Although binary signals have significantly greater fidelity than analogue (Dawkins, 1976) they are not immutable meaning that it is possible for changes to be incurred. So, while recursive

[5] Hypothesised that within culture binary encoding occurs as the presence or absence of a meme at a given locus

transmission corresponds to reproduction, errors introduce variation. Selection is determined by what patterns of information are acceptable. Thereby corresponding to Gabora's (1997) criteria for an evolutionary pattern.

Notions drawn from signal electronics, such as fidelity (S/N), hamming distance, parity & error correction, the binomial distribution, Gray code and Hamiltonian paths, therefore are appropriate for the formation of evolutionary models of information transmission and are amenable to automated processing. Both MENDEL and EDEN-ML (Appendix C) are constructed upon discrete principles.

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[i] Shannon's paper on PCM http://cm.bell-labs.com/cm/ms/what/shannonday/shannon1948.pdf

[ii] Biographical note http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Hamming.html

[iii] PCW definition: Hamming distance http://pespmc1.vub.ac.be/ASC/HAMMIN_DISTA.html

[iv] Asserted by http://www.cut-the-knot.com/do_you_know/Strings.shtml

[v] Weisstein's world of mathematics definition: metric http://mathworld.wolfram.com/Metric.html

[vi] http://merlin.mbcr.bcm.tmc.edu:8001/bcd/Curric/MathAn/mathan.html The Mathematical Basis of Molecular Phylogenetics (Dress, A., 1995)

[vii] Biographical note http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Shannon.html

Appendix C: MENDEL

Phenetic processing upon meme strips required the development of specific software. The need for, objectives, specifications, implementation and other details of the MENDEL and EDEN-ML[1] system are described in this appendix.

C.1 Problems of computational complexity

A measure known as computational complexity is important to computer science and software engineering as it gives some indication of how long certain processes may take to calculate a result thereby providing better choices for implementation (Sommerville, 1995). This is not synonymous with the "new science" of Complexity but rather a function between the size of the data set and the number of atomic operations (and therefore duration) required by the algorithm (See Gell-Mann, 1994). An algorithm that simply sums a column of figures (iterated addition) would have linear complexity as the number of operations approximates the number of figures to be summated. A (clumsy) sort algorithm that for each member of the data set, must compare every member of the data set with every other, on the other hand would have a geometric complexity[2]. Other, more complex and hideous, forms of non-linear computational complexity exist and it becomes clear that after a certain point, depending on complexity, actual processing becomes unfeasible using certain technologies.

The options of numerical taxonomy accepted in this research, though deliberately minimalist, still entail that the phenetic algorithm has a high degree of computational complexity beyond that available to the human manual calculation. As Sneath and

---

1 For the want of a better name and in the best traditions of software, a somewhat contrived acronym was required that captured its essences and heritage in genetics and evolutionary theory yet incorporated notions of memetic evolutionary lineage. After much deliberation, the acronym MENDEL[tm] was chosen. *Memetically Enabled Numerical Derivation of Evolutionary Lineages* reflects that the meme concepts allows numerical taxonomic methods to infer institutional descent and is named in honour of Augustinian monk Gregor Mendel, who was the first person to trace the characteristics of successive generations of a living thing. While MENDEL analyses, EDEN-ML[tm] *Enumerated Descending Evolutionary Nodes – Mark-up Language*, synthesises the genesis of meme strips.

2 This is analogous with an old legend about the king of Persia's offer of any request to Sessa for inventing the game of chess. Sessa asked for one grain of wheat for the first square of the board, two for the second and four for the third, eight for the fourth and so on. This rapidly exceeds the world's supply (Flemming & Varberg, 1988)

Sokal (1973) point out, although phenetic distance had been used as early as 1898 by Heincke to distinguish between different types of herring, the labour intensive arithmetic involved prohibited use on large data sets and hence impeded development. The phenetic approach required the advent of sufficiently powerful computer technology before it became widely accessible. Implementation of the algorithms therefore has relied on contemporary technology.

C.2 Implementation objectives & decisions

C.2.1 Make of buy

Several issues have influenced the "make or buy" decision - that is, for the author to develop bespoke software or use existing packages. There are several inexpensive (relative to cost of development time) commercial or shareware packages that are available such as MacClade, Phylip, EasyTree, Clustan etc. While some of these are excellent in doing what they do, they have tended to be application specific and "stand alone" – have limited interface to standardised components. It would have been possible, with effort, to contort the research data into their specific file formats for a limited number of trial runs. The following factors, however, indicated that specification and implementation from scratch was the optimal approach:

- *Flexibility of application*: most available software was oriented specifically towards molecular approaches of DNA or protein sequences and required specific input file formats to reflect this information. Of more general application is "Clustan" (Wishart, 1998, 1999a, 1999b) which has been used (Wishart, 2002; Kraaijeveld, 2001) to classify whiskeys similarly to that used by Lapointe & Legendre (1994) approach. This would have been appropriate for initial testing unfortunately, its existence was discovered only after successful bespoke implementation. The software was also required to perform auxiliary analysis upon the data such as landscape generation and distribution analysis (Lord et. al. 2002) through interfacing to other packages such as those for generating graphics.
- While clustering methods are well documented (Sneath & Sokal, 1973) the underlying operation (code) of the existing applications are hidden and not a cessible for modification. Where source code was available (Phylip), then reverse engineering this (from the legacy language of "C") would be more time consuming and error prone than a green-field development using a modern

software paradigm. The decision to re-develop the software enabled the definition of the all the underlying parameters within the algorithm along with ability to experiment with and tailor them. Further, as the code modules were accessible then testing of hypothetical scenarios, such as Eden (§C.4.4) was facilitated.

- Software was intended primarily for evaluation of the methodological hypothesis. If those results proved encouraging then that would open opportunities for refinement of the method along with other means and topics for future research application. Existing stand-alone applications where code access is denied have their upgrade potential capped. This means that they may not have the power to meet emerging research demands. Consideration of these factors at the outset suggested the more modern object paradigm, which was not supported by existing packages.

C.2.2 Other objectives

The requirement to build the software from scratch entailed that further decisions were required about development methodology[3], platform and programming paradigms to be used.

Flexibility. Although the software was constructed to meet a specific purpose, it was not intended to be restricted solely to this purpose. Rather, it was anticipated at the outset that the specification would change as new problems, opportunities and methodological revelations occurred. This meant that the software would not have to be rebuilt with every requirement change but was capable of maintenance. Because of the requirement to build the software from scratch, the opportunity arose to engineer inherent expansion flexibility into the system from the very beginning.

Platform. The PC operating Windows 98 operating system and Microsoft Office 2000 is such a common and accessible configuration that it was chosen as the environment in which the system should operate. Visual BASIC for Applications (VBA), a component of Microsoft Office (and other applications such as Corel Draw) provided a flexible and commonly supported programming environment by which the system, or data, could be transferred between packages with ease. Furthermore, the

[3] Software engineering, unfortunately confuses the term methodology with method (Jayaratna, 1994)

design philosophy of the environment already supports proposed automated research methods such as interfacing the system with the Internet.

Evolutionary prototyping. The need for flexibility and the ability to adapt to ongoing specification changes suggested the development methodology of evolutionary prototyping (Sommerville, 1995).

Object based approach. The object paradigm was also appropriate for creating generic classes of object such as a *NodeTree* as it allowed for the activation of methods and properties. While VBA is not fully object oriented, it supports the paradigm through the use of class modules and can be compiled as ActiveX objects for embedding in applications.

C.3 Specification and algorithm

The system will take a set of taxa with their character states from some host application and will, in that or some other application, graphically plot trees, which have been calculated through a selected algorithm (such as clustering of Hamming distances through UGPMA).

C.3.1 General Architecture

An overview of MENDEL's software architecture is given in Figure C-1.

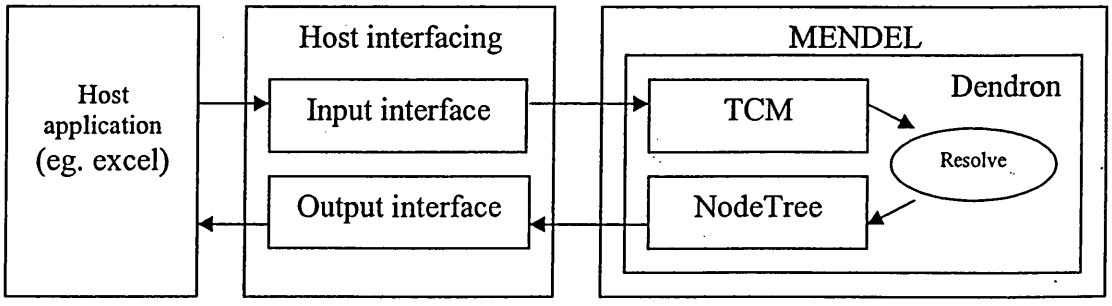


Figure C-1: block diagram of system architecture

Host interface: while the system is to work with any ActiveX supporting system, systems may store data in different ways thereby requiring conversion to an internal data structure. For example Excel and Access would need translating first as a spreadsheet and data object are different. Furthermore, the way that packages handle

drawing objects is also different. For this reason, to be used with a given host application, an interface needs to be developed.

MENDEL: the software consists of the *dendron* class module, which is a container for

- *The taxa character matrix* (TCM), which is the data set of organisations and their traits presented by the host interface from, for example, an excel spreadsheet.
- The phenetic processing algorithm(s) with options for various similarity coefficients and clustering strategies.
- at least one *node tree* data structure, which results from processing and displayed pictorially by the host application.
- The *Resolve* method, which is public and used to trigger off execution of the phenetic algorithm.

C.3.2 Algorithm

A general outline of the algorithm activated by the *Resolve* method is presented here and its hierarchical decomposition is depicted in figure C-2.

C.3.2.1 Data objects

There are four main data objects using in the process

- ***TCM*** The *taxa character matrix* of the source data as presented to the routine from the interface. This contains the name of the matrix, the OTU and character labels along with each character state and any formatting information.
- ***NTR*** The resultant *node tree* that the routine calculates. This is a set of nodes that contains each OTU as a leaf node along with internal nodes that represent branching. All nodes have an ID and, other than the root node, have their parent node's ID and so constitutes a tree structure that can be constructed into a graphical depiction. Nodes also may have auxiliary information such as a label colour and order. The *NTR* object is capable of presenting statistics about the tree (width, depth etc.), allowing queries to the relationships between organisational nodes and also provides methods such as inserting, deleting and reordering nodes.
- ***UnresolvedNodes*** Nodes are processed in turn during the course of execution. The *UnresolvedNode* object is simply a list of the IDs of nodes in the node tree that remain to be processed. Node IDs are deleted when resolved or added through the introduction of an internal cluster. This list is implemented as a temporary collection to speed up the program and is deleted on completion.
- ***BaseMatrix*** The distances between nodes are represented by a 2D array called the *BaseMatrix,* which allows the closest pair to be found quickly. Distances to clusters are calculated as clusteral nodes are introduced (as a new row and column).

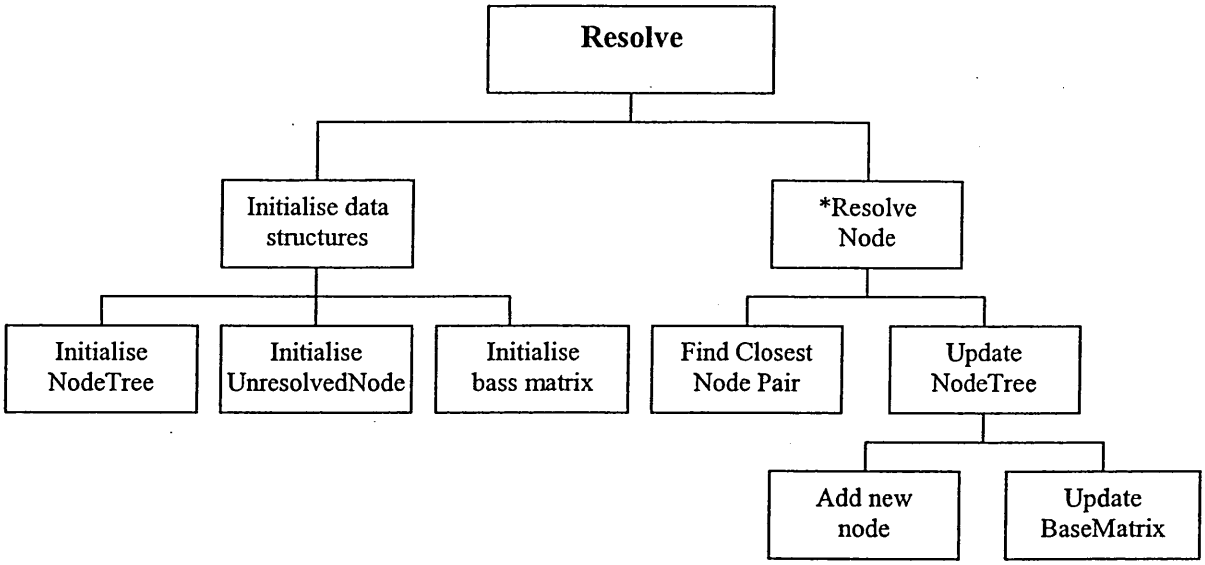


Figure C-2: top down hierarchical decomposition of "resolve" method in Dendron module

C.3.2.2 Procedures

Resolve consists of initialising the *NodeTree, UnresolvedNode* and *BaseMatrix* data structures and then iteratively resolving unresolved nodes. The examples of functioning are derived from the test harness data (described in §C.4.1) and show the initial data structures and the first round of processing. Objects initialised are as follows:

Initialise NodeTree: For each OTU in the TCM, a node is added to the node tree and assigned and ID, parent IDs are initially assigned to *null* (parent not found) and will change in due course as nodes become resolved. Additional data such as the labels are also assigned at this point (Table C-1).

Node ID	Parent ID	Label
1		A
2		B
3		C
4		D
5		E

Table C-1. Initialised Node Tree

Initialise UnresolvedNodes: As no nodes are initially resolved then the IDs of the nodes in the node tree are simply copied to *UnresolvedNodes* collection and is initially a list of the IDs in the node tree (Table C-2).

Initialise base matrix: The meme strips (drawn from the TCM) of initial nodes are compared to each other using the Hamming (or other) distance metric and the results are placed in a two dimensional array[4] (Table C-3 is based on the test harness data §C.4.1) for quick future reference (i.e. finding the closest node pairs).

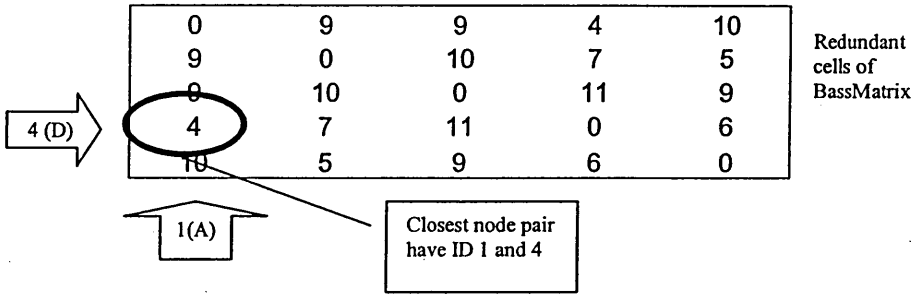


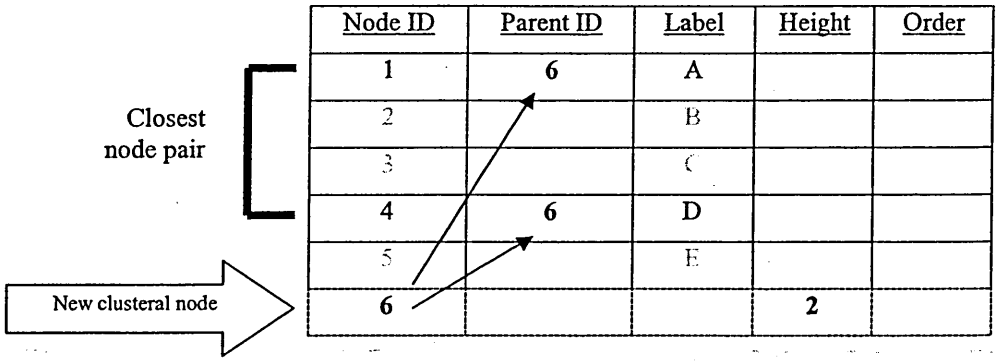
Table C-3. initialised *BaseMatrix*

After initialising the data structures, the *Resolve* method iteratively[5] *Resolves Nodes* until there are no more nodes to resolve (i.e. UnresolvedNodes list is empty). The resolution of each node involves the *finding of the closest node pair,* which results in the *updating of the node tree* as follows.

[4] As the Hamming distance is a *reflexive* and *symmetric* relation then the shaded area in Figure C-3 represents redundant data down the diagonal (where $H_d(a, a) = 0$) and cells mirrored by the diagonal where $H_d(a, b) = H_d(b, a)$

[5] Iteration is denoted by * in JSP type diagrams as figure C-2

Find closest node pair: From the intersections of the base matrix that are co-ordinates of unresolved nodes, the lowest distance is found (Fig. C-3) and returned along with the IDs of this closest node pair. As in the example, initially no nodes are resolved so all of the first 5 X 5 cells are checked. The lowest value, 4 is in (column 1, row 4) meaning that nodes labelled A and D are the closest (also Fig. C-4).



Node ID	Parent ID	Label	Height	Order
1	6	A		
2		B		
3		C		
4	6	D		
5		E		
6			2	

Table C-4. Closest node pair clustered as new node

Update NodeTree: The closest node is used to *update the node tree*, which involves *adding a new node* and then *updating the base matrix.*

Add new node A new clusteral node is added to the node tree, (Fig. C-4) and assigned an ID (eg 6). The parent IDs of the closest node are set to the ID of the newly created node (eg 6). The closest node pair were then removed from the unresolved node list (eg. 1 & 4) while the new node (eg 6) was added to it (Table C-5).

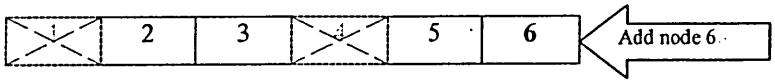


Table C-5. Updated values of UnresolvedNodes list

Update BaseMatrix . The creation of a new clusteral node is accompanied with the creation of both a row and column in the base matrix and the distances to other nodes are calculated for further rounds of *Resolve node* (Fig. C-6).

The distance between node n and the newly formed cluster m is the mean distance (using UPGMA[6]) between n and the cluster's components p & q.

$$H_d(n, m) = H_d(n, p) + H_d(n, q) /2$$

0	9	9	4	10	2	Node 1
9	0	10	7	5	8	
9	10	0	11	9	10	
4	7	11	0	6	2	Node 4
10	5	9	6	0	8	
2	8	10	2	8	2	New row (node 6)

$H_d(2, 6)= (9+7)/2$

New column (6)

Table C-6. update of base matrix upon adding new clusteral node (node 6)

In figure C-6, closest node pair (1 & 4) have been clustered as node 6 so, for example the distance of node 2 to this new cluster (second cell of the new 6^{th} row) is given by:

$$H_d(2, 6) = H_d(2, 1) + H_d(2, 4) / 2 = (9 + 7) / 2 = 8$$

C.3.3 Host interface (Microsoft Excel)

The easiest way of using the system was to place a command button on a worksheet that, when clicked, opened a friendly user form (Fig. C-3). The full implementation of the form is fairly sophisticated and some features have been included for future expansion. Use can be achieved, however, by combo boxes to select the worksheet, entering the range of the data (in spreadsheet A1 format) then clicking "Quick" – this plots the results to the current worksheet (by default) in an area printable to A4 landscape paper.

Speed of execution As testing would require numerous executions of the programme then, in order to reduce the project timescale by increasing frequency of feedback, it became important to chose the algorithm with the minimum computational complexity by identification and elimination of operational redundancy.

[6] Though other options for clustering strategies exist.

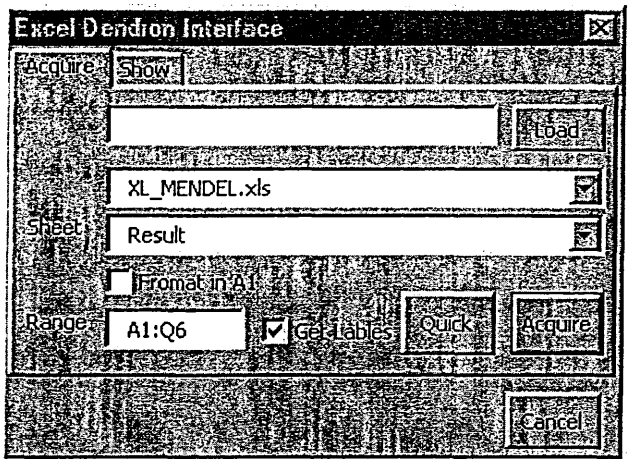


Figure C-3. Interface to MENDEL system

C.4 Implementation, Testing and Results

Implementation was done in VBA for MS Excel on the grounds that Excel readily supported a graphical table format. A rigorous methodology for validating and verifying each key element of MENDEL was implemented along with consistent coding and documentation conventions.

C.4.1 Test harness data

Primitive functionality of the clustering algorithms was performed upon a very small artificial test data set. The results at every stage of the algorithm (Boolean encoding, hamming distance, distance matrix, all class modules and dendrogram) were calculated by hand and thoroughly checked for correctness. These acted as a benchmark against which the program's results could be verified.

The initial data for this was entered fairly randomly into an excel worksheet as MyMatrix (Table C-7) and the template for the distance matrix was set up on the same worksheet. For each pair of OTUs (operational taxonomic units) the places where they differed were then laboriously counted (to provide hamming distance) and this was entered into the relevant cell of the distance matrix.

MyMatrix	ch1	ch2	ch3	ch4	ch5	ch6	ch7	ch8	Ch9	ch10	ch11	ch12	ch13	ch14	ch15	ch16	hex
A		1			1	1		1		1	1	1				1	=4D71
B		1	1				1		1	1	1	1	1		1		=62FA
C		1		1	1		1	1	1					1	1	1	=5B87
D								1		1	1	1					=0170
E			1				1	1			1		1		1		=232A

Table C-7. Test taxa character matrix

The clustering method was then applied by iteratively finding the smallest unused values, creating a new row and column, and calculating the clusteral distances until the distance matrix was complete (Table. C-8).

OTU		1 –"A"	2 –"B"	3 –"C"	4 –"D"	5 –"E"	6 –(1, 4)	7 –(2, 5)	8 –(6, 7)
	(Hex)	4D71	62FA	5B87	0170	232A			
1 –"A"	4D71	0	9	9	4	10	2	9.5	5.75
2 –"B"	62FA	9	0	10	7	5	8	2.5	5.25
3 –"C"	5B87	9	10	0	11	9	10	9.5	9.75
4 –"D"	0170	**4**	7	11	0	6	2	6.5	4.25
5 –"E"	232A	10	**5**	9	6	0	8	2.5	5.25
6 –(1, 4)		2	8	10	2	8	2	8	5
7 –(2, 5)		9.5	2.5	9.5	6.5	2.5	**8**	2.5	5.25
8 –(6, 7)		5.75	5.25	**9.75**	4.25	5.25	5	5.25	5.125

Table C-8. Manually calculated distance matrix

Analysis revealed clusters (as marked out in Table C-8) between

Nodes 1 and 4 with a Hamming distance of 4 was clustered as node 6 (ie "A & D")

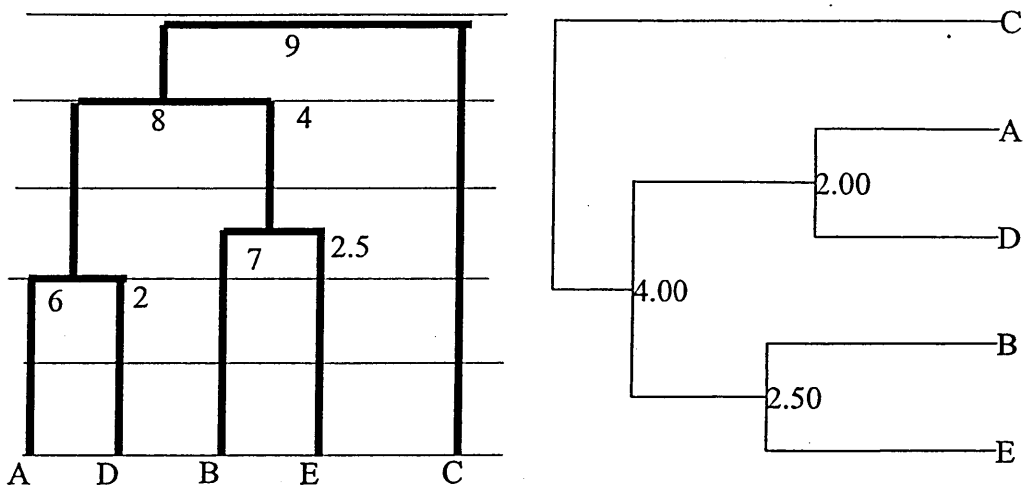
Nodes 2 and 5 with a Hamming distance of 5 was clustered as node 7 (ie "B & E")

Nodes 6 and 7 with a Hamming distance of 8 was clustered as node 8 (ie "A, D, B & E")

Nodes 3 and 8 with a Hamming distance of 9.75 was clustered globally

The tree diagram was then manually drawn with respect to the cluster distances[7] using Excel's drawing toolbar. Each of these stages was tested against MENDEL's intermediate results (not depicted). Figure C-4 shows a comparison between the manual version (done as a vertical icicle plot) and the computer generated horizontal version. Although the display parameters make these plots look different from each other, they are topologically identical and represent exactly the same information indicating that both the computational and display aspects of MENDEL are verified by the test harness data.

[7] As two nodes (or clusteral nodes) form a cluster then that the cluster's centre is halfway between the two nodes. Hence, the distance from a node to the clusters centre is half of the distance between the two nodes involved.



Manual plotting of manually calculated results

Automatic plotting performed by MENDEL

Figure C-4. Test data plotting

C.4.2 Whiskey Classified

Lapointe and Legendre's (1994 – henceforth L&L) classification of whiskey is useful, not only because it gives an indication of how such a (abiotic) dataset can be constructed and processed but, moreover, because they, rather conveniently, placed the entire data set that they used on the Internet as an Excel spreadsheet that can be used directly with MENDEL allowing results to be compared. While, in difference to minimalist algorithms adopted here, the L&L system used Jaccard similarity & Wards[8] correlation coefficients the results are anticipated to have and did exhibit certain similarities. Comparison between trees was frustrated to some extent because of the current lack of sophistication of dendrographic analysis[9] or metrics of similarity (between trees) built into the software. Comparison had to fall back on laborious manual comparison through colour coding[10] (as described in part 2). This involved first tracing the bitmapped phenogram in L&L's web based paper into a Corel draw as a vector image and retyping all the OUT identifiers (ie. whiskey names) into the image (optical character recognition did not work owing to poor GIF resolution). The major groupings in L&L's classification were then colour coded. MENDEL's plot

[8] Again, the objective of the exercise was neither to construct a definitive phenogram of whiskeys nor to evaluate the accuracy clustering options but rather to test MENDEL's efficiency against large data sets and to see if there were any resemblances. Early implementations of MENDEL, before streamlining, required overnight processing thereby slowing frequency of feedback in software development.

[9] A topic for further research as suggested in Part 4

[10] A process that, taking about two days to complete, prohibited extensive testing.

was then copied and pasted into Corel draw and resized to match. The colour coding of L&L were then established in the second plot by a long series of find operations. Though imperfect at higher levels, the patterns were reflected between those phena that were close in both. In other words, the groups tended to be the same but the relationship between the groupings went awry which is put down to the difference in coefficient assumptions. This suggests that lower level grouping remain intact between the two systems. Other permutations of coefficients remain to be tested.

C.4.3 EDEN-ML

MENDEL's open architecture and class module implementation allows other auxiliary modules to be incorporated into the project. One of which was called EDEN-ML that simulated an ideal evolutionary scenario on abstract binary strips based on rudimentary assumptions. The test harness data (§C.4.1) was non-evolutionary but used to check that MENDEL programme performed clustering correctly against a known pattern. EDEN-ML, on the other hand, enabled the genesis of test data by selected evolutionary assumptions[11]. By putting simulated test data (a *taxa character matrix* called "diversity") through MENDEL's analytical module (*Dendron*) it became possible to reconstruct the pattern of descent (as a *node tree*). During the simulation EDEN-ML also recorded the ongoing patterns of descent and was capable of providing this data independently (as a *node tree* called "phylogeny"). Hence the phenogram (indirect diachronic reconstruction of descent reconstructed from the end diversity) could be compared with the phylogram (actual pattern of descent as historically recorded) as per the method detailed in §2.5.5. Unfortunately, it was not possible to define or implement any automated tree comparison algorithm, however it was possible to display these dendrograms side-by-side as graphs on the spreadsheet (using a module called *Treeline*) thus allowing visual comparison.

[11] As well as testing MENDEL, EDEN-ML was intended as a mark-up language for codifying evolutionary assumptions and executing genesis simulations – such as exploring cultural phase space in the development of novel organisational forms proposed in part 4.

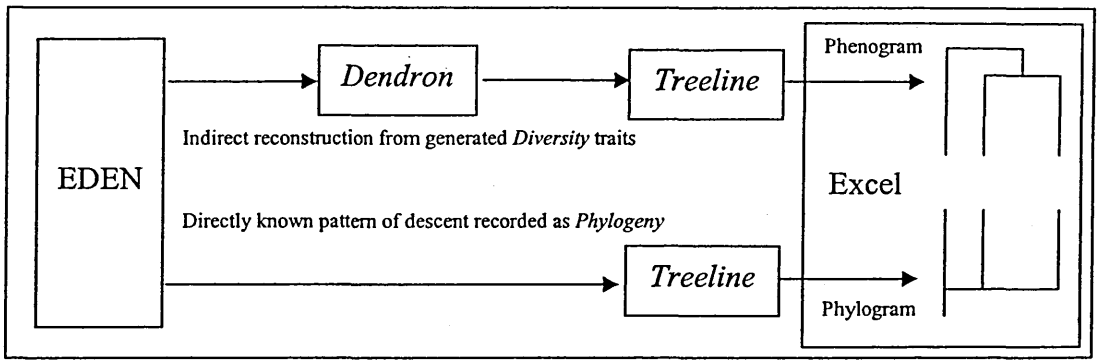


Figure C-5. Comparison of reconstructed phenogram against with recorded phylogram

In the current test oriented implementation EDEN-ML module has two main properties

Diversity: which just returns a *taxa character matrix* using identification numbers as labels but without any time stamp data

Phylogeny: which parses via parents' identification numbers in order to directly generate a node tree data object

Some simple assumptions were made in that

- The probability of any bit mutating was equal – therefore diversity follows the binomial distribution
- Different strips entailed that their hamming distance would be >0 and were only allowed to exist in the *Diversity* collection once
- The probability that any particular strip would meet with its demise in any round was equal
- At the end of a simulation run all ancestors of any extant strip were culled so that no OTU's within the analysis would be ancestral to any another.

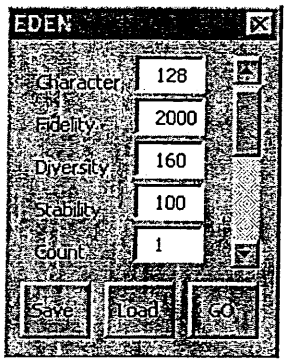


Figure C-6. EDEN interface

The simple VB form interface (Fig. C-6) shows the parameters that could be assigned (and their defaults). Characters are the number of bits in the strip (default 128); Fidelity is the probability that any character may switch in any round (1:2000); Diversity is the target number of unique strips at which the simulation terminates (160); Stability is the probability that a strip will meet its demise in any given round (1:100); and count is the number of simulations to be shown on a worksheet (1).

The exact influence of these parameters on the distribution of the diversity was not assessed owing to time limitations. However, the defaults could be processed in reasonable time, produced readable dendrogram and conferred reliable reconstructions[12]. Along with testing MENDEL's ability to reconstruct an idealised evolutionary scenario Eden produced results that lead to some interesting auxiliary conjectures[13] that are beyond the scope of this volume.

C.4.4 Essential oils

Various plants produce essential oils which can be extracted and are used by aroma-therapists (among others) for their medicinal properties. Holland & Barrett (a UK nutritional retail chain) package with their oils a guide as to their use, which includes a grid of oils (rows) and usage (columns) in a format that could be processed by MENDEL thus giving an opportunity for further testing. A more detailed table was obtained from a clinical aromatherapist. It was hypothesised that related plants (of common ancestry) would produce similar essential oils hence having related therapeutic applications. This would mean that a phenetic reconstruction based on the

[12] Again, no metric of accuracy was attempted and comparisons were left to judgement using the method of manually colouring in groups and seeing where the blocks of colour matched.
[13] Such as the bats wing distribution, the paperclip chain linkage model and the timed phenogram

aromatherapist's guide should at least have a passing resemblance to an existing taxonomy of plants. The process involved was:

i. To identify the botanical names of the species the listed oils are extracted from[i],
ii. find a relevant taxonomy (ie Cronquist) and for each species identified – determine the family, subclass, class and phylum[ii],
iii. create a tree showing the relationships between species,
iv. transcribe the aromatherapy guide into spreadsheet form and run the process,
v. and compare the results.

Although the dendrograms did not provide a perfect match, there was sufficient resemblance to support the hypothesis. The point of this exercise, however, was to provide additional testing for the software and hence a full treatment of the essential oils test is beyond the scope of the current volume.

C.5 Software conclusion

Building the software from scratch was the most appropriate approach. A clear software development methodology combined with extensive testing, suggested that the resulting software conferred sufficient reliability and speed in processing the phenetic algorithms along with confirming the validity of the algorithms against known data. This software was used to test the methodology against a specific organisational sector as shown in Part 4.

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[i] Aromaweb http://www.aromaweb.com/essentialoils/default.asp provides profiles on many essential oils and absolutes.

[ii] The flowering plant gateway http://www.csdl.tamu.edu/FLORA/newgate/gateopen.htm provides four systems of angiosperm classification.

Appendix D: Theological Typologies

D.1 Melton's Religious Family Groupings

J. Gordon Melton's authoritative work *The Encyclopedia of American Religions* (1996) organizes all religious bodies in North America into twenty (20) families. Families share three common features: heritage, theology or belief (in a broad sense), and lifestyle. The religious movements page[1] lists religious groups in the U.S. and Canada and organises them into Melton's family groupings. Although many of these were not featured as taxa, they are included here for completeness.

D.1.1 Melton's family groupings

- Western Liturgical
- Eastern Liturgical
- Luthern
- Reformed-Presbyterian Family
- Pietist-Methodist Family
- Holiness Family
- Pentecostal Family
- European Free-Church Family
- Baptist Family
- Independent Fundamentalist Family
- Adventist Family
- Latter-day Saints Family
- Communal Family
- Christian Science-Metaphysical Family
- Spiritualist, Psychic, and New Age Family
- Ancient Wisdom Family
- Magick Family
- Middle Eastern Family
- Eastern Family
- Unclassified Christian Churches
- Unclassified Religious Groups

[1] http://religiousmovements.lib.virginia.edu/profiles/listmelton.htm

D.1.2 Grouping details

D.1.2.1 *Western Liturgical*

The Vatican
National Conference of Catholic Bishops
United States Catholic Conference
Old Roman Catholic Church in North America
The Anglican Catholic Church
The Anglican Catholic Church of Canada
Anglican Catholic Church in America
Episcopal Church

D.1.2.2 *Eastern Liturgical*

American Orthodox Catholic Church
Antiochian Orthodox Christian Archdiocese
Byzantine Catholic Church
Greek Orthodox Archdiocese of America
Orthodox Church in America
Romanian Orthodox Episcopate of America
Russian Orthodox Church Outside of Russia
Russian Orthodox Church in USA
Armenian Church of America, Diocese of
Syrian Orthodox Church of Antioch

D.1.2.3 *Luthern*

Lutheran World Federation
American Association of Lutheran Churches
Church of the Lutheran Brethren of America
Evangelical Lutheran Church in America
Evangelical Lutheran Church in Canada
Evangelical Lutheran Synod
Lutheran Church - Canada
Lutheran Church - Missouri Synod
Wisconsin Evanglical Lutheran Synod

D.1.2.4 *Reformed-Presbyterian Family*

Canadian and American Reformed Churches
Reformed Church in America
Bible Presbyterian Church
Cumberland Presbyterian Church
Presbyterian Church in America
Presbyterian Church USA
Conservtive Congregational Christian Conference

D.1.2.5 *Pietist-Methodist Family*

Evangelical Covenant Church
Evangelical Free Church of America
Moravian Church in America
United Methodist Church
General Board of Global Missions
African Methodist Episcopal Church
Christian Methodist Episcopal Church

D.1.2.6 Holiness Family

Christian and Missionary Alliance
Church of the Nazarene
Salvation Army, International
United States Salvation Army
Wesleyan Church

D.1.2.7 Pentecostal Family

Pentecostal World Conference
Church of God (Cleveland)
Church of God of Prophecy
International Pentecostal Holiness Church
Assemblies of God, General Council of the
Association of Vineyard Churches
Calvary Chapel
International Church of the Foursquare Gospel
Open Bible Standard Churches, Inc.
Pentecostal Assemblies of Canada
Pentecostal Church of God
Branham Tabernacle and Related Assemblies
Apostolic Faith
Bible Way Church of Our Lord Jesus Christ World Wide
Pentecostal Assemblies of the World
United Pentecostal Church International
Way of the Cross Church of Christ
Church of God in Christ
Soldiers of the Cross of Christ, Evangelical International Church
Association of Evangelical Gospel Assemblies International
Integrity Communications (and related ministries)

D.1.2.8 European Free-Church Family

Mennonite World Conference
Mennonite Church
Evangelical Friends International
Friends General Conference
Friends United Meeting

D.1.2.9 Baptist Family

Baptist World Alliance
American Baptist Association
American Baptist Churches in the USA
Baptist Bible Fellowship International
Baptist Missionary Association of America
Canadian Baptist Ministries
Fellowship of Evangelical Baptist Churches in Canada
General Association of Regular Baptist Churches
North American Baptist Conference
South Carolina Baptist Fellowship
Southern Baptist Convention
Progressive National Baptist Convention, Inc.
Baptist General Conference
National Association of Free Will Baptists, Inc
Seventh Day Baptist General Conference USA and Canada Ltd
International Churches of Christ

D.1.2.10 Independent Fundamentalist Family

Grace Gospel Fellowship

D.1.2.11 Adventist Family

Seventh-Day Adventist Church
General Conference of the Church of God (Seventh Day)
Worldwide Church of God
Jehovah's Witnesses
British-Israel-World Federation (Canada) Inc.
International Association for Religious Freedom
American Association for the Advancement of Atheism
American Ethical Union
Atheists United
Unitarian Universalist Association
Universal Life Church

D.1.2.12 Latter-day Saints Family

Church of Jesus Christ of Latter-day Saints
Reorganized Church of Jesus Christ of Latter Day Saints

D.1.2.13 Communal Family

The Peace Mission Movement
The Family

D.1.2.14 Christian Science-Metaphysical Family

Church of Christ, Scientist
Religious Science International
Universal Foundation for Better Living

D.1.2.15 Spiritualist, Psychic, and New Age Family

National Spiritualist Association of Churches
Foundation Church of the New Birth
Seth Network International
Trinity Foundation
Aetherius Society
Unarius - Science of Life
United States Raelian Movement
Church of Scientology
Foundation of Human Understanding
Huna International
Huna Research
Inner Peace Movement
Urantia Foundation

D.1.2.16 Ancient Wisdom Family

Astara
The Theosophical Society in America
Church Universal and Triumphant

D.1.2.17 Magick Family

Fellowship of Isis
Pagan Federation/Federation paienne-Canada
Universal Federation of Pagans
Cymry Wicca
Temple of Set

D.1.2.18 Middle Eastern Family

Conservative Judaism c/o United Synogogue of Conservative Judaism
Reform Judaism
Church of God and Saints of Christ
American Muslim Council
Gurdjieff Foundation
Ahmadiyya Anjuman Ishaat Islam, Lahore, Inc.
Ahmadiyya Movement in Islam
Nation of Islam (John Muhammad)
Meher Baba
Baha'i Faith

D.1.2.19 Eastern Family

American Meditation Society
Ananda Marga Yoga Society
Disciples of Sri Aurobindo
Brahma Kumaris World Spiritual University
Free Daist Communion
International Society for Krishna Consciousness
Self-Realization Fellowship
Sivananda Yaga Vendanta Centers
Vedanta Society of New York
Osho Commune International
ECKANKAR
Movement of Spiritual Inner Awareness
American Buddhist Congress
Thai-American Buddhist Association: Wat Tahi of Los Angeles
AUM Supreme Truth
Nichiren Mission
Nichiren Shoshu Temple
Rissho Kosei Kai
Dharma Realm Buddhist Association
Healing Tao Centers
Mahikari of America
Shinreikyo
Tenrikyo

D.1.2.20 Unclassified Christian Churches

D.1.2.21 Unclassified Religious Groups

Appendix E: Theological Characters

E.1 Character table

Characters are split into two main groupings: the first is the structure, organisation and leadership involved in the religious body while the second concentrates on the theistic beliefs of that body. These groups are broken down into classes of characters. These classes refer to the wider topics in Christian theology while the characters themselves are individual beliefs or issues. It is only the level of character that is of importance and levels above are mainly for convenience as they are irrelevant to the phenetic algorithm. Each character could then be ascribed a Boolean value do denote whether a particular operational taxonomic unit possessed such or not.

Group	Class	Character
Structure	Type	Extant, Incorporated, movement, theology
	Leadership/Polity	Hierarchical, Episcopalian, Presbyterian, Congregational, Autonomy, Charismatic Leadership, Papal Authority, Prophet Founder, Women ministers
	Life	Excommunication, Lifestyle, Proselytic, Exclusivist
Belief	Godhead	Unitarian, Trinitarian, Infinitarian
	Christology	Son, Arian, Monophysitism, Modalistic Monarchianism
	Soteriology	Predestination, General Atonement, Particular Atonement, Solifidianism, Faith &Works
	Eschatology	Amillennialism, Postmillennialism, Dispensational Premillennialism, Date Setting
	Hermeneutics	Fundamentalist
	Sabbath	Sunday, Saturday
	Sacrementology	Baptism, Paèdobaptism, Belief, Total Immersion, Jesus only Formula, Spirit Baptism, Holy Eucharist, Confirmation, Penance, Orders, Matrimony, Extreme Unction
	Peculiarities	Soul Sleep, Annihilation, Investigative Judgement

Entries were drawn from various dictionaries and encyclopaedias and in many cases are direct quotations or modifications of such. The referencing system for selected characters are abbreviated as follows:

DC	Dictionary Of Cults, Sects, Religions And The Occult (Mather & Nichols, 1993)	
DP	Dictionary Of Pentecostal And Charismatic Movements (Burgess & McGee, 1988)	
DT	Dictionary Of Theology	
NL	NRM Links	http://cti.itc.virginia.edu/~jkh8x/soc257/home.htm
CE	Catholic Encyclopedia	http://www.newadvent.org/cathen
CO	Catholic Online	http://www.catholic.org/prayer/#sacrament
CA	Catholic Answers	http://www.catholic.com/index.htm
DD	Devil's dictionary	http://ecco.bsee.swin.edu.au/text/ddict/

E.2 Characters Defined

Each character will be given a description of what it is taken to mean in this research. Though these may not correspond to a strict metaphysical theological definition (for *Naturalistic* reasons) attempts have been made to adhere to the dictionary meaning. A full treatment of each theological term is beyond the scope and intention of this appendix.

E.2.1 Structure

E.2.1.1 Type

E.2.1.1.1 Extant

A religious body is considered Extant if it is deemed to be in current existence though sufficient adherents. Bodies, such as the Branch Davidians are not considered Extant (rather, extinct) even though there are a few followers still they have no significant presence.

E.2.1.1.2 Incorporated

The incorporated character refers to a taxon's status as a distinct incorporated body as opposed to a loose movement, theology, parachurch group or individual congregation. An example is the transition of a bible studies group (in the c1840s Adventist movement) into the Seventh Day Adventists in 1863.

E.2.1.1.3 Movement

A movement here is taken to mean some unincorporated body yet who share a distinct and popular common belief. An example is the Adventist movement of William Miller, which drew from Baptist, Methodist, Presbyterian and Congregationalist denominations in New England.

E.2.1.1.4 Theology

A theology (as taken as a religious entity type) is similar to a movement in that it is not an incorporated religious body yet is considered to be some intermediate form of "entity" that constitutes a taxon. Such an entity is distinguished from a movement in that it is characterised by a distinct conceptual theology idea in as opposed to a sociological phenomena. An example is Calvinism.

E.2.1.2 Leadership/Polity

E.2.1.2.1 Hierarchical

A hierarchy is a top-down social structure of control and influence in the form of a pyramid. From Greek *hieros*, 'sacred' and *arche*, 'rule' refers to the ordered levels of authority in the structure of the Church (DT). The term here refers to a structure that structure isn't restricted to religious phenomenon but also is found in commercial, military and other organisations.

E.2.1.2.2 Episcopalian

Episcopacy is a system of church government that is characterised by the presence of the office of Bishop (or equivalent in other denominations)

E.2.1.2.3 Presbyterian

The term Presbyterian is used to denote the principle of church polity in which the ministry is that of presbyter or elder (DT). The Presbyterian approach recognises the autonomy of each local assembly while at the same time has a central control or headquarters that exists to serve the local congregations. (DP)

E.2.1.2.4 Congregational

The essential principle of the polity of congregationalism is the autonomy of the worshipping congregation to the exclusion of any deciding authority outside it (DT).

E.2.1.2.5 Charismatic Leadership

In difference to the theological usage of *charisma* meaning "gift of grace" (DT), the term is used here to refer to leadership that is established by an individual with a strong dominant personality, effective interpersonal skills and acquired social/political/financial power. This is in opposition to leadership by appointment to an office.

E.2.1.2.6 Papal Authority

A character (of Roman Catholicism) of the acceptance of the inerrant authority of the bishop of Rome (DT). Protestantism typifies rejection of this authority.

E.2.1.2.7 Prophet Founder

The "gift of prophesy" has been claimed by (or of) certain individuals and in certain circumstances has lead to the formation of a movement of followers. In such cases the founder is a prophet.

E.2.1.2.8 Women ministers

Western Christianity has been traditionally patriarchal. Modern issues have involved the acceptance, by certain groups, of the ordination of women ministers.

E.2.1.3 Life

E.2.1.3.1 Excommunication

Some groups are strictly insistent on the acceptance of members of the beliefs, moral codes and lifestyle so the group. Those that are not prepared to embrace such face excommunication (de-fellowshipping in the case of the Jehovah's Witnesses)

E.2.1.3.2 Lifestyle

Some groups require that members adopt certain "moral" lifestyles such as dress codes, blood donation, military service, abstinence of alcohol, dancing and theatre going.

E.2.1.3.3 Proselytic

Some groups are particularly energetic and have a central agenda of attempting to gain converts through evangelistic activity such as witnessing, outreach programmes and open-air evangelism (Howe, 1991; Warner, 2000). Other groups are more reserved or insular and are non-prosylitic.

E.2.1.3.4 Exclusivist

This is the belief by the particular group that there is only one true church and all others are counterfeits (produced by Satan). Also that that group and only that group have exclusive claim to the truth and that all others are wrong (in spite of some common beliefs). (DC)

E.2.2 Belief

E.2.2.1 Godhead

The doctrine of god may consider deist, pantheist or atheist positions along with various concepts in theism. Western Christianity, however generally accepts monotheism and rents in theology have been concerned predominantly with the concept of the trinity. Three characters are assessed in this research:

E.2.2.1.1 Unitarian

The Unitarian perspective rejects the trinity, claiming that god is not three separate', but rather, *one* unified person (DC).

E.2.2.1.2 Trinitarian

The doctrine of the trinity is that the godhead consists of three equal persons of the Father, Son and Holy Spirit (DC).

E.2.2.1.3 Infinitarian

An unorthodox doctrine that god is unlimited in number (DC) is referred to here by the "Infinitarian" character.

E.2.2.2 Christology

The nature and person of the Christ (as opposed to his works of *soteriology* or that of historical Jesus of Nazareth) (DT) has been argued since ancient time and while most of the numerous opinions are academic, certain ones have resulted in schism. Generally, Christological heresies (DC) overemphasise either the deity or humanity of Christ from the orthodox position of the hypostatic union. The predominant variations on Christology were considered as characters.

E.2.2.2.1 Son

The doctrine of the Son refers to Christ as the Son of God though this does not imply that he is the second person of the trinity.

E.2.2.2.2 Arian

A major early Christological heresy, which treated Jesus Christ as the supreme of God's creatures, and denied his divine status. The Arian controversy was of major importance in the development of Christology during the fourth century.

E.2.2.2.3 Monophysitism

Monophysitism teaches that Christ had a single divine nature as opposed to the Chalcedon view or Christ's dual nature (DC).

E.2.2.2.4 Modalistic Monarchianism

Monarchianism is an Anti-Trinitarian doctrine that teaches that God comprises of a single being. The Modalistic sense is a slight variation where God manifests himself as three different modes throughout history (DC).

E.2.2.3 Soteriology

Soteriology is the area of Christian theology that deals with the fall of man of sin and God's redemptive work. Of particular importance to this research are distinctions in atonement and routs to salvation.

E.2.2.3.1 Predestination

The doctrine that all things occur according to programme. This doctrine should not be confused with that of foreordination, which means that all things are programmed, but does not affirm their occurrence, that being only an implication from other doctrines by which this is entailed.(DD)

E.2.2.3.2 General atonement

The word atonement, constructed from *at* and *one*, means "to set at one" or "to reconcile." In Christian Theology, atonement denotes the doctrine of the reconciliation of God and man accomplished by the Crucifixion and death of Jesus Christ. Unlike the pure Calvinists, Arminians insisted that Christ died for all, but that his death would only benefit those who would choose him.

E.2.2.3.3 Particular atonement

Limited atonement as the theory that the death of the Lord Jesus Christ on Calvary's cross was strictly limited in any and all of its aspects only to the elect or saved ones, or believers in Christ. It had nothing whatsoever to do with the unsaved or the non-elect people of the world.

E.2.2.3.4 Solifidianism

The doctrine of justification by faith in Christ alone (*sola fide*), apart from merit or works is called solifidianism (DT). This was voiced by Luther and became a central tenet of Protestantism.

E.2.2.3.5 Faith and Works

In difference to solifidianism, other groups may believe that justification requires works in addition to faith.

E.2.2.4 Eschatology

While theologically, *cosmogenesis* (the beginning of time) is the *Creation,* the end time is the *Eschaton* and is concerned with the end of human history and the *parousia* or return of Christ after a thousand years (the millennium in the theological sense). Interpretations differ in terms of when the end times and the millennium (DT).

E.2.2.4.1 Amillennialism

The amillennial interprets Revelation 20 symbolically and sees the millennium not as an earthly golden age in which the world will be totally Christianised, but as the present period of Christ's rule through his Church on earth and in the coexistence of good and evil on earth until the end. The golden age of the millennium is instead the heavenly reign of Christ with the saints, in which the Church on earth participates in some degree, though not in the glorious way it will at the Second Coming. (CA)

E.2.2.4.2 Postmillennialism

Postmillennialism is where the Second Coming, the general resurrection of the dead, and the last judgment occur *after* the millennium. The term millennium is generally taken to be figurative meaning "a long time". (CA)

E.2.2.4.3 Dispensational Premillennialism

Premillennialism is the doctrine that there will be an earthly reign of Christ established by His second coming. His coming will *initiate* a 1,000-year period, the millennium, in which peace and righteousness will be the rule. The dispensational variety of premillennialism forewarning of holocaust, Armageddon, and rapture. (CA; DP; http://www.credenda.org/issues/vol7/esch7-6.htm)

E.2.2.4.4 Date Setting

Date setting eschatology is where the return of Christ and therefore the apocalypse has been numerologically calculated from biblical prophecy to be on a specific date. Most non-date setting variations rather tend than placing a date just state sometime in the near future (DT).

E.2.2.5 Hermeneutics

E.2.2.5.1 Fundamentalist

The term fundamentalist is used here to denote the principle of biblical inerrancy and literal interpretation of scripture and all that that entails (DT).

E.2.2.6 Sabbath

E.2.2.6.1 Sunday

This is traditional Sunday observance of the Christian day of rest and worship chosen from early times as the weekly festival of the Lord's resurrection (DT).

E.2.2.6.2 Saturday

This is where the original Jewish Sabbath (the seventh day of creation week) is taken as the day of rest and worship as opposed to the more usual Christian Sunday.

E.2.2.7 Sacramentology

Sacraments are outward signs of inward grace, instituted by Christ for our sanctification (Catechismus concil. Trident., n.4, ex S. Aug. "De Catechizandis rudibus"). Sacraments involve or imply promise or a commitment, and they are mysteries in the sense that they do not disclose their meaning to unbelieving eyes. Baptism and the Eucharist are regarded as *the dominical sacraments* as they were instituted by Christ himself (DT).

E.2.2.7.1 Baptism

Initiation of new members into the Church has been by baptism. Theologically baptism signifies what god has done for our salvation through Christ. Baptism is the sacrament that frees man from original sin and from personal guilt that makes him a

member of Christ and His Church. It is thus the door to a new and supernatural life (CO)

E.2.2.7.2 Paedobaptism

Some denominational families practice infant baptism (*paedobaptism*) by sprinkling water on babies in order to effect the remission of original sin as early as possible in life (DT).

E.2.2.7.3 Belief Baptism

Belief baptism is a character whereby paedobaptism is insufficient for salvation but rather re-baptism by consent and by confession of belief is necessary to be "saved". This is typical of being "born again".

E.2.2.7.4 Total Immersion Baptism

Total immersion baptism, as the term suggest, requires total bodily immersion in water as opposed to mere sprinkling of water as a formula for baptism (DP).

E.2.2.7.5 Jesus Only Formula Baptism

The orthodox baptismal formula is Trinitarian. Other, non-Trinitarian formulas exist an important one of which is given only Jesus' name (Beisner, 1998; DP)

E.2.2.7.6 Spirit Baptism

Spirit baptism refers to an experience whose basis is believed to be found in the event of Pentecost (Acts 2:1-4). Those who hold spirit baptism as essential to salvation place particular emphasis on glossolalia (speaking in tongues) as initial evidence of baptism in the spirit (DP).

E.2.2.7.7 Holy Eucharist

Holy Mass (or otherwise) is a real sacrifice, instituted by Christ at the Last Supper. It represents Christ's sacrifice of the Cross, but in an unbloody manner. The wheat bread and grape wine are transubstantiated by the ordained priest into the flesh and blood of Christ so that only the appearance of bread and wine remains. The sacrament effects union with Christ. (CO)

E.2.2.7.8 Confirmation

The sacrament of confirmation completes the sacrament of baptism. If baptism is the sacrament of re-birth to a new and supernatural life, confirmation is the sacrament of maturity and coming of age. (CO)

E.2.2.7.9 Penance

A baptised person who sins again, sins against God. The forgiveness of sins is a true sacrament instituted by Christ, different from baptism, particularly on account of its

judicial form. Sins are forgiven only by the sacrament of penance. Sins are forgiven by absolution, which can only be given by an authorized priest. (CO)

E.2.2.7.10 Orders

The degrees of order - the four minor and three major orders with the highest of all, that of Bishop - signify an order of rank in the mediation of grace. (CO)

E.2.2.7.11 Matrimony

Matrimony is the marriage contract between Christians raised by Christ to the dignity of a sacrament. Matrimony and order are the two sacraments which not only serve the individual in reaching this goal but are there for the benefit of the community. Matrimony is there for the mutual help of the spouses and the increase of the people of God. (CO)

E.2.2.7.12 Extreme Unction

Penance restores the justification lost by sin, extreme unction takes away the infirmity left by sin. Only a priest can validly administer extreme unction to any baptised person who has reached the age of reason and is on account of sickness or age in danger of death. (CO)

E.2.2.8 Peculiarities

Certain non-orthodox peculiarities are included for sects that have a particular eschatological focus.

E.2.2.8.1 Soul Sleep

Soul sleep is the belief that when a believer dies, he remains in the unconscious state of existence in the grave until God resurrects him (Berry, 1987).

E.2.2.8.2 Annihilation

Annihilation of the wicked is the belief that the wicked will cease to exist and will not suffer everlasting torment in the fires of hell as this is entirely unscriptural (Berry, 1987).

E.2.2.8.3 Investigative Judgement

The investigative judgment is part of the ultimate disposition of all sin, typified by the cleansing of the sanctuary on the Day of Atonement and reveals to the heavenly universe those among the dead who are deemed worthy to take part in the first resurrection. (NL)

Appendix F: TCM

The data set used in phenetic processing was represented as the following taxa character matrix (TCM as per the MENDEL software).

The religious bodies described in part 3 were taken as the operational taxonomic units (OTUs) shown abbreviated in column headings. The theological traits in Appendix E are row headings (in the third column, the 1st and 2nd are convenient groupings) and constitute the characters. The cells depict the presence (1) or absence (0) of a character for an OTU.

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Appendix F: Taxa Character Matrix

		RC	ACC	Calv	GB	PB	SBC	L	R	P	C	Q	A	JW	SDA	DSDAA	BD	CG7	WCG	COZ	CP	CG(CT)	AG	BR	CC	UPC	SA	M	(M)WMC	(M)IM	(M)MNC	(M)WRU	(M)PMC	(M)BC	(M)UMFC	(M)UMC
Structure																																				
Type	Extant	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	0
	Incorporated	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Movement	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Theology	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leadership/Polity	Hierarchical	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	1	1	1	1	1	-1	1	1	1	1
	Episcopalian	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Presbyterian	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Congregational	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Charismatic L	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Papal Authority	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Prophet Founder	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Women ministers	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1
Belief *Godhead*	Unitarian	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Trinitarian	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
	Infinatarian	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Christology	Son	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Arian	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monophysite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Modal Monarchianism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Soteriology	Sola Fide	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1
	General atonement	1	0	0	1	0	0	1	1	0	1	0	0	1	1	0	0	1	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1
	Particular atonement	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Predestination	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Faith & Works	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eschatology	Amillennial	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Postmillennial	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	premillennial	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Date Setting	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H	Fundamentalist	1	0	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Sab	Sunday	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
	Saturday	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sacramentology	Baptism	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Baptism	Infant	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
	Belief	0	0	0	1	1	1	0	0	0	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Total Immersion	0	0	0	1	1	1	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	J only Formula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Spirit Baptism	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Other sacraments	Holy Eucharist	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1
	Confirmation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Penance	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orders	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Matrimony	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Extreme Unction	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Life	Excommunication	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Lifestyle	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1
	Prosalytic	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
	Exclusivist	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peculiar	Soul Sleep	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Annihilation	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Investigative Judgement	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

F.2 Abbreviations

RC	Roman Catholic
ACC	Anglican Catholic Church
Calv	Calvinist
GB	General Baptist
PB	Particular Baptist
SBC	Southern Baptist Convention
L	Lutheran
R	Reformed
P	Presbyterian
C	Congregationalist
Q	Quaker
A	Adventist
JW	Jehovah's Witnesses
SDA	Seventh Day Adventists
DSDAA	Davidian Seventh Day Adventist Association
BD	Branch Davidians
CG7	Church of God Seventh Day
WCG	Worldwide Church of God
COZ	City of Zion
CP	Classical Pentecostal
CG(CT)	Church of God (Cleveland Tennessee)
AG	Assemblies of God
BR	Brownsville Revival
CC	Calvary Chapel
UPC	United Pentecostal Church
SA	Salvation Army
M	Methodist
(M)WMC	Wesleyan Methodist Connexion
(M)IM	Independent Methodists
(M)MNC	Methodist New Connexion
(M)WRU	Wesleyan Reform Union
(M)PMC	Primitive Methodist Connexion
(M)BC	Bible Christians
(M)UMFC	United Methodist Free Churches
(M)UMC	United Methodist Churches

Table F-2. Religious Bodies Abbreviations

Appendix F: TCM

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Structure	*Type*	Extant	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	0
		Incorporated	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Movement	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		Theology	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Leadership/Polity	Hierarchical	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
		Episcopalian	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
		Presbyterian	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
		Congregational	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
		Charismatic L	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Papal Authority	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Prophet Founder	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Women ministers	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1
Belief	*Godhead*	Unitarian	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
		Trinitarian	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
		Infinatarian	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Christology	Son	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Arian	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Monophysite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Modal Monarchianism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Soteriology	Sola Fide	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1
		General atonement	1	0	0	1	0	0	1	1	0	1	0	0	1	1	0	0	1	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1
		Particular atonement	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Predestination	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Faith & Works	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Eschatology	Amillennial	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Postmillennial	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
		premillennial	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
		Date Setting	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	*H**	Fundamentalist	1	0	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Sab	Sunday	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
		Saturday	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sacramentology	*Baptism*	Baptism	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
		Infant	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
		Belief	0	0	0	1	1	1	0	0	0	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
		Total Immersion	0	0	0	1	1	1	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
		J only Formula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
		Spirit Baptism	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Other sacraments	Holy Eucharist	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1
		Confirmation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Penance	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Orders	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Matrimony	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Extreme Unction	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Life	Excommunication	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Lifestyle	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1
		Prosalytic	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
		Exclusivist	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Soul Sleep	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Peculiar	Annihilation	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Investigative Judgement	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

F.2 Abbreviations

RC	Roman Catholic
ACC	Anglican Catholic Church
Calv	Calvinist
GB	General Baptist
PB	Particular Baptist
SBC	Southern Baptist Convention
L	Lutheran
R	Reformed
P	Presbyterian
C	Congregationalist
Q	Quaker
A	Adventist
JW	Jehovah's Witnesses
SDA	Seventh Day Adventists
DSDAA	Davidian Seventh Day Adventist Association
BD	Branch Davidians
CG7	Church of God Seventh Day
WCG	Worldwide Church of God
COZ	City of Zion
CP	Classical Pentecostal
CG(CT)	Church of God (Cleveland Tennessee)
AG	Assemblies of God
BR	Brownsville Revival
CC	Calvary Chapel
UPC	United Pentecostal Church
SA	Salvation Army
M	Methodist
(M)WMC	Wesleyan Methodist Connexion
(M)IM	Independent Methodists
(M)MNC	Methodist New Connexion
(M)WRU	Wesleyan Reform Union
(M)PMC	Primitive Methodist Connexion
(M)BC	Bible Christians
(M)UMFC	United Methodist Free Churches
(M)UMC	United Methodist Churches

Table F-2. Religious Bodies Abbreviations

Appendix G Results

Phylogenealogy: Family tree of Christianity

Part 3 showed the construction of each denominational family; figure G-1shows how these families relate to each other. The common ancestor is Roman Catholicism, denoted by the black line top left. This is split into the Episcopalian family (in purple) and the Reformational family in orange. The reformational family then subdivides into the Pentecostal (blue) and Adventist (red) families.

In these constructions it can be seen that the pattern is generally divergent. However, among Methodist and Pentecostal there are also patterns of division and merger. The Jehovah's witnesses experienced severe fracturing (light orange) but owing to lack of data are not fully included in the study.

The structure in G-1 (a *'phylogram'* for present purposes) can be reorganised to a simpler pattern as in figure G-2, which ignores the splits and mergers and just depicts extant taxa. Figure G-3a abstracts the main denominational families and G-3b provides a minimal depiction.

Phenogram - Phylogram Comparisons

Macro level

Three comparisons are provided for the overall study. Figure G-4a depicts the unweighted phenogram (and its abstracted structure) while G-4b and G-4c provide experimental re-weightings of the "bishop meme". In each of the cases tested, the micro level structure was preserved while the macro structure altered with different weightings. Figure G-5 shows the comparative influence of the "Bishops" at the macro level. Notably, the Episcopalian cluster appears closer to the Reformed one where the B-meme is low, but flips over to become closer to the Roman Catholicism where the B-meme is high.

As the order of the taxa are largely irrelevant then various transformations are possible on these diagrams. Like a mobile made of wire-hangers, groupings can be "rotated" while retaining their essential structure. Figure G-6 shows a comparison between the different abstracted phenograms of "bishop" weightings and the minimalist phylogram. It can be seen that each result can be transformed such that it produces a match with the phylogram. This raises certain methodological issues, which are discussed in the main text.

Micro level

At the micro level, shown in figure G-7 faith groups are compared. Figure G-7a shows both the Episcopalian and Reformed families. The most significant anomaly is the cross over of the general Baptists and the Congregationalists.

The Pentecostals are shown in G-7b. The ICFG and PAW were omitted from the phenetic reconstruction owing to lack of data. The interesting mismatch is the distinction between BR and AG.

Similarly, in the Adventist group G-7c, the WCG jump to being an out-group when it is closely related to the CG7. The Original Millerite Adventists, like the Quakers, do not adhere to their origins.

The micro and macro levels can be composed into a single diagram as in figure G-8 that which shows the overall comparison.

Appendix H: Some Memetic Definitions

The definition of the meme is ambiguous and open to debate (Rose, 1998) though Aunger (1999) has said that definitional uncertainties should not impede progress. This appendix is a collection of various attempts to define the meme. It is not intended to be complete, fully referenced or in any particular order.

Glenn Grant http://www.nada.kth.se/~nv91-asa/Trans/meme_lex.html

Meme (pron. *meem*): A contagious information pattern that replicates by parasitically infecting human minds and altering their behaviour, causing them to propagate the pattern. (Term coined by Dawkins, by analogy with "gene".) Individual slogans, catch-phrases, melodies, icons, inventions, and fashions are typical memes. An idea or information pattern is not a meme until it causes someone to replicate it, to repeat it to someone else. All transmitted knowledge is memetic.

Tony Lezard http://maxwell.lucifer.com/virus/alt.memetics/#Lezard

Richard Dawkins, who coined the word in his book *The Selfish Gene* defines the meme as simply a unit of intellectual or cultural information that survives long enough to be recognized as such, and which can pass from mind to mind. There's not much of a sense of describing thought processes, but nor is it just a model. As Richard Dawkins writes (this is from memory), "God indeed exists, if only as a pattern in brain structures replicated across the minds of billions of people throughout the world." (Of course the patterns aren't physically identical, but they represent the same thing.)

H. Keith Henson ftp://planchet.rutgers.edu/nanotech/papers/memes

A meme survives in the world because people pass it on to other people, either vertically to the next generation, or horizontally to our fellows. This process is analogous to the way willow genes cause willow trees to spread them, or perhaps closer to the way cold viruses make us sneeze and spread them.

Peter J. Vajk http://www.uio.no/~mwatz/memetics/memetics.txt

It is important to note here that, in contrast to genes, memes are not encoded in any universal code within our brains or in human culture. The meme for vanishing point perspective in two-dimensional art, for example, which first appeared in the sixteenth century, can be encoded and transmitted in German, English or Chinese; it can be described in words, or in algebraic equations, or in line drawings. Nonetheless, in any of these forms, the meme can be transmitted, resulting in a certain recognizable element of realism which appears only in art works executed by artists infected with this meme.

Heith Michael Rezabek http://www.uio.no/~mwatz/memetics/rez.on.memes

My favourite example of a crucial meme would be "fire" or more importantly, "how to make a fire." This is a behavioural meme, mind you, one which didn't necessarily need a word attached to it to spring up and spread, merely a demonstration for another to follow. Once the meme was out there, it would have spread like wildfire, for obvious reasons... But when you start to think of memes like that -- behavioural memes -- then you can begin to see how language itself, the idea of language, was a meme. Writing was a meme. And within those areas, more specific memes emerged.

Lee Borkman http://maxwell.lucifer.com/virus/alt.memetics/#Borkman

Memes, like genes, vary in their fitness to survive in the environment of human intellect. Some reproduce like bunnies, but are very short-lived (fashions), while others are slow to reproduce, but hang around for eons (religions, perhaps?). Note that the fitness of the meme is not necessarily related to the fitness that it confers upon the human being who holds it. The most obvious example of this is the "Smoking is Cool" meme, which does very well for itself while killing off its hosts at a great rate.

Richard Dawkins http://maxwell.lucifer.com/virus/alt.memetics/faq.html#Dawkins

Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches. Just as genes propagate themselves in the gene pool by leading from body to body via sperm or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation. If a scientist hears, or reads about, a good idea, he passes it on to his colleagues and students. He mentions it in his articles and his lectures. If the idea catches on, it can be said to propagate itself, spreading from brain to brain. Memes should be regarded as living structures, not just metaphorically but technically. When you plant a fertile meme in my mind, you literally parasitize my brain, turning it into a vehicle for the meme's propagation in just the way that a virus may parasitize the genetic mechanism of a host cell. And this isn't just a way of talking -- the meme for, say, 'belief in life after death' is actually realized physically, millions of times over, as a structure in the nervous systems of people all over the world. – [Dawkins, 1976]

Dawkins A *The Selfish Gene*

`..a unit of cultural transmission, or a unit of imitation.' (*Dawkins 1976*, p.206); `Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches' (*Dawkins 1976*, p.206); `Popular songs and stiletto heels are examples. Others, such as the Jewish religious laws...' (*Dawkins 1976*, p.209); `Perhaps we could regard an organised church, with its architecture, rituals, laws, music, art and written tradition, as a co-adapted stable set of mutually-assisting memes.' (*Dawkins 1976*, p.212); `Memes for blind faith have their own ruthless ways of propagating themselves.' (*Dawkins 1976*, p.213). – [Quoted in Gatherer, 1998]

Dawkins B *The Extended Phenotype*

(referring to the original Dawkins A definition, above) `..I was insufficiently clear about the distinction between the meme itself, as replicator, on the one hand, and its `phenotypic effects' or `meme products' on the other. A meme should be regarded as a unit of information residing in a brain..... It has a definite structure, realized in whatever physical medium the brain uses for storing information....I would want to regard it as physically residing in the brain.' (*Dawkins 1982*, p.109); `The phenotypic effects of a meme may be in the form of words, music, visual images, styles of clothes, facial or hand gestures.....' (*Dawkins 1982*, p.109). – [Quoted in Gatherer, 1998]

Derek Gatherer http://www.cpm.mmu.ac.uk/jom-emit/1998/vol2/gatherer_d.html

One who spends so much effort criticising the meme definitions of others, ought to present a clear target for his own critics. The following is therefore offered: Meme: an observable cultural phenomenon, such as a behaviour, artefact or an objective piece of information, which is copied, imitated or learned, and thus may replicate within a cultural system. Objective information includes instructions, norms, rules, institutions and social practices provided they are observable. – [Gatherer, 1998]

Richard Brodie *Virus of the Mind*

A *meme* is a unit of information in a mind whose existence influences event such that more copies of itself get created – [Brodie, 1996, p32].

William Durham Coevolution: genes, culture, and human diversity

Meme: any kind, amount, and configuration of information in culture that shows both variation and coherent transmission. – [Durham, 1991]

John Wilkins http://jom-emit.cfpm.org/1998/vol2/wilkins_js.html

A meme is the least unit of sociocultural information relative to a selection process that has favourable or unfavourable selection bias that exceeds its endogenous tendency to change. – [Wilkins, 1998]

Oxford English Dictionary

meme (mi:m), n. Biol. (shortened from mimeme ... that which is imitated, after GENE n.). An element of a culture that may be considered to be passed on by non-genetic means, esp. imitation

Don Beck & Christopher Cowan Spiral Dynamics

A [V]MEME reflects a worldview, a valuing system, a level of psychological existence, a belief structure, an organizing principle, a way of thinking or a mode of adjustment. It represents, firstly then, a *core intelligence* that forms systems and directs human behaviour. Secondly, it impacts upon *all life choices* as a decision–making framework. Thirdly, each [V]MEME can manifest itself in both *healthy and unhealthy* forms... - [Beck & Cowan, 1996 p4]

Aaron Lynch http://jom-emit.cfpm.org/1998/vol2/lynch_a.html#HEADING7

... the principle abstractions manipulated with memetics theory are memory abstractions, or *mnemons*[3]. Mnemons do not include inanimate propagating items such as chain letters, Bibles, etc. Nor do they include traits considered genetically instinctual. – [Lynch 1998]

Appendix I

Emergent Behaviour in a New Market: Facilities Management in the UK

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Tackling Industrial Complexity:

The ideas that make a difference

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I.1 Abstract

The growth of the FM market in the UK is analysed to test the proposition that it will display the characteristics of a memetically modified Complex Adaptive System. The capture of market share displays an imperfect power law relationship. The total market, divided by service offering and client sector, and scaled for volume, shows a terrain with apparent fitness peaks around which groups of players have clustered. The classification of participating firms according to the similarity in their market offering reveals an apparent phyllogeny that matches ancestry; the clusters or clades reveal the separate parent industries from which current players have entered the new ecosystem. The study illustrates the utility of an evolutionary paradigm to describe and appreciate changing and emerging markets and the power of memetic phyllogeny as a classifier tool in such markets.

I.2 INTRODUCTION

At least since the early days of the Santa Fe Institute, Complexity theory has proposed, and been thought to explain, markets as a class of Complex Adaptive Systems (CAS) (Heylighen, 1966; Middleton Kelly, 1997) yet few specific studies of same appear to have been published in the public domain. Complexity and CAS is much used as a metaphor or a subject for theoretical and critical discussion, but specific applications remain hard to

find.[1] The research described here sought to establish firstly whether a new market does indeed show the features predicted by CAS theory, and secondly whether the information thus revealed is of relevance to strategists in that market. The market examined is that for the provision of outsourced Facilities Management (FM) services in the UK (see below). Our hypothesis was that it would show such features and our hope was that relevance could be demonstrated.

Stemming from that hypothesis is the first question. What exactly does CAS predict as to the properties which will be displayed by such a market?

I.2.1 The Edge of Chaos

Despite the widespread association of complexity science with the Santa Fe Institute (popularised by Waldrop, 1994) most of the principles can be found in older general systems theory. Waddington (1977) for example synthesised most of them some 10 years prior to the founding of the Institute. One defining *leitmotif* of modern complexity which he missed, albeit narrowly, is the concept of the edge of chaos; a claimed narrow zone of maximum adaptability poised between rigid order and randomness. Emergent innovation, it is argued, happens more naturally when populations are balanced close to this edge (e.g. Pascale et al., 2000), and is indicated by a lognormal distribution between the size of self-organised entities and their frequency.

Much has been made of the metaphor in the last 10 years including the popular claim that living systems themselves evolve on the edge of chaos. In fact, Kauffman's own (1993; 1995) analysis of extinction data in the fossil record lead him to argue some departure from pure edge of chaos conditions: a conclusion supported by subsequent research (Newman and Eble, 1998). Similar objections have been made for mature industries, whose surviving participants - if the economic niche survives[2]- frequently trend towards monopolies or oligopolies (e.g. Porter, 1980). Neither the biological nor the

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[1] A recent Internet search for the string +*"Complex Adaptive Systems"* +*Markets* yielded 885 hits with 'financial markets' in approximately 50%. Only one (Charteris undated) attempted to analyse a specific industrial sector. Fleming and Sorenson (2001) have in press at the time of writing an empirical study showing that the fitness (measured by subsequent citations) of patents shows at least aome of the properties of a CAS.

[2] Other reasons for a decline in the population of firms occupying a niche are of course possible. The niche itself may disappear, or less frequently be invaded by new and vigorous competitors. Aldrich (1999) lists several original case studies.

organisational trend is necessarily surprising. An Evolutionary Stable Strategy, if it can be achieved, suits the 'selfish replicators', gene complexes or meme complexes in either case (Price, 1995; 1999; Price and Shaw, 1998).

In young industries founding rates are typically small to start with but increase as a population grows; a phenomenon attributed to growing 'legitimacy' (Hannah and Freeman, 1989). Some have argued (Aldrich, 1999) that the early growth phase will favour 'r-strategists' - the comparitors of species who mature rapidly and disperse a large number of seeds / offspring in the hope of some surviving whereas the latter phases will favour K-strategists, those who seek to dominate a single niche excluding competitors

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The UK market for FM services is still young and does not appear to have reached its carrying capacity (see below). We might therefore expect a distribution of market share approaching a power spectrum and potentially signs of a shift from 'r' to 'K' strategies.

I.2.2 Inheritance of Memetic Schemata

While several developments in complexity science seek to play down Darwinian evolution, or even argue for its replacement (see critique by Dennett, 1995[3]) others, notably Gell-Mann (1994: 1996) stress the role of auto replicating schemata. Gell-Mann (1996) explicitly links schemata and memes:

> In the case of societal evolution, the schemata consist of laws, customs, myths, traditions, and so forth. The pieces of such a schema are often called "memes,"

a position consistent with the combination of organisational memetics (Price, 1995; Price, 1999) and the theming of memetics and phyllogeny / cladistics (McCarthy et al., 1997: Lord and Price, 2001) as a strand in the complexity and manufacturing research agenda (McCarthy, 1998). The combination predicts that firms entering the new market will be influenced by their memetic inheritance: i.e. their relative market positions might reflect the industries from which they were derived. FM (see below) has attracted players from a variety of industrial backgrounds and provides a good opportunity to examine this proposition.

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[3] Dennett tends to treat Kauffman as seeking to escape from Darwin's dangerous idea, a position not necessarily justifiable (Price, 1999)

I.2.3 Fitness landscapes, lock-in and path dependency

Wright's classic (1932) metaphor of the fitness landscape has been rejuvenated or, considered as a meme, has found new niches in the discourse space of complexity, (Lissack, undated), again spurred (Fleming and Sorenson, 2001) by Kauffman's (1993, 1995) models. A more rugged, multi peaked landscape, is predicted under 'edge of chaos' conditions with sufficient but not total interdependence between the actions of agents in a system. Actual models of new markets are hard to locate, perhaps because of the multiple dimensions possible in social fitness landscapes. We have endeavoured to construct a fitness landscape for the UK FM market, scaled by market size, service offered and customer sectors served. We are not aware of similar attempts in other markets.

The concepts of path dependency and lock-in, (c.f Arthur, 1994 contra Margolis and Liebowitz, 1998), or of memetic imitation between players as particular offerings and segments gain legitimacy, would suggest some fitness peaks (niches) might grow at the expense of others. Rothschild (1992), in surveying technological evolution, presents several examples of newer technologies first thriving outside the major domains they were subsequently to displace while Aldrich (1999) reviews studies of industries converging onto accepted designs, and standards. At one level such convergence, by increasing legitimacy, makes expansion of, and entry into, a market easier. For individual entrants however, a market can become crowded especially if it is maturing,. Older entrants may find themselves vulnerable to even small increases in competitive advantage from new competitors.

I.3 FACILITIES MANAGEMENT IN UK AS A TEST CASE

I.3.1 Background

The British Institute of Facilities Management claims, on its website, to have remained, since its formation in 1993, the fastest growing professional body in the United Kingdom. Most of the members are individual professionals though there is an increasing corporate membership from organisations providing goods and services. The 34 largest firms in that industry recorded, in the last financial year, a collective turnover of ca £3.5bn[4]. Nine UK

[4] www.i-FM.net August 2000. The total size of the UK market remains an estimate but this figure, the outsourced component may still be under 10% of that total.

universities now offer postgraduate programmes in FM, all in courses established since 1991.

The term 'Facilities Management' originated in the late 1960's[5] in the USA to describe the then growing practice of banks outsourcing responsibility for processing of credit card transactions to specialist providers. The oldest record yet traced via Internet databases (Scott, 1971) describes 'Facilities Management' as follows:

> The credit-card opens a new set of problems requiring intelligent communication between credit card processing centres on a nation-wide basis. With this requirement comes a need for large terminal networks to allow merchants to obtain immediate credit information and also to record and process all information pertinent to a sale.

In 1978 furniture manufacturer Herman Miller, by coincidence the subject of an early case study of emergence in corporate history (Hench, 1999), convened a meeting in Ann Arbor Michigan to discuss developing trends in office design terming them Facility Management. Participants in the workshop founded the American, and subsequently the International, Facility Management Association (IFMA) devoted to the integrated management of working environments. FM in that sense persists to this day in the USA and has developed its own traditions of research, professional practice and education.

In crossing the Atlantic the two uses became confused. Records survive of Sir Monty Finniston[6] speaking in April 1983 to the Manchester Society of Architects:

> I should like the architect to become involved in what I believe the Americans call facilities management, giving constant attention to improving the efficiency of the building ... enhancing the environment inside ... and keeping it in good repair, (providing the after sales service which is often lacking)

It is clear he was referring to what the Americans referred to as Facility Management however in the UK 'Facilities' became the preferred term; one adopted by both workplace design specialists and the operational managers of buildings, in particular in the computing and electronics industries (Thompson, 1988). By ca. 1990, with the rise of business process reengineering and a corporate focus on white-collar productivity such services were beginning to be outsourced, a trend which strengthened in the recession of the early 1990s. Meanwhile government policies firstly on 'Market Testing' and

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[5] This history is summarised from a more comprehensive treatment (Price, 2001). As part of that research an international panel of contributors to a volume on FM were surveyed as to when they first heard the term used. The earliest date was 1968. According to Norman Rose, Director General of BSA, the term Facilities Management was coined by Ross Perot when he founded Electronic Data Systems. It was used to describe the outsourcing of IT operations (PFM, June 2001, page 11)

[6] The report is made in what was then the in house journal produced by Francis Duffy's architectural practice DEGW. Duffy is generally credited with bringing the ideas to the UK.

Compulsory Competitive Tendering (CCT) and subsequently on PFI provided a significant boost to the service provision industry.

The development of FM is probably best conceived from the perspective of management fashions (c.f. Abrahamson, 1996: Scarborough and Swann, 1999). Viewed against many other 'fashions' it has some claim to longevity. Abrahamson and Fairchild (1999) argue for considering management fashions, specifically quality circles in the example they analyse, as self-replicating discourses. Price and Shaw (1996) took a similar stance arguing for the consideration of 'fads' as an example of memes, Dawkins' (1976) hypothetical cultural replicators. It is not unusual for replicating fads / fashions to take on several shades of meaning; indeed from the metaphorical viewpoint of a 'selfish replicator' diversity of meaning facilitates faster replication. The professional institutes now found in most developed economies, the educational research and consulting activities in FM, and the industry providing FM services can be considered as forms of organisation enabled by the FM meme, in, of course, conjunction with others[7]. Those in different sectors see it differently (Green and Price, 2000).

3.2 Characterising the market

Defining the Facilities Management market in the UK is problematic. No single FTSE listing or SIC code applies. Many of the perceived main players are subsidiaries of other groups and the activities tendered range from large PFI or 'Corporate' PFI deals, some of which involve transfer of significant property assets, to requests for the provision of single services. A recent trend (see below) has been for construction companies to seek to relist themselves or their FM subsidiaries as service providers on the London Stock Exchange, driven by the perception that investors attach a premium to the services sector.

The market developed 'organically' as the term FM came into use in the early 1990. In some cases, existing providers of various outsourced support services chose simply to label themselves as offering FM. One marketing executive interviewed recalled (pers comm. to IP 9/11/01):

> We had three companies. XXX Maintenance had been a subsidiary company offering Building Maintenance for ca 28 years. XXX FM Ltd was formed in 1993 / 4 in response to the wonderful new buzzword of FM that had appeared. People wanted to see the word management in an outsourcing contract. YYY Asset and Facilities Management had been formed in 1990 in preparation for the PSA sale and outsourcing of Defence Estate.

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7 Leading industrial, professional, and academic figures in UK FM hold different perspectives on whether it is a profession or an industry, perspectives which did not change through 4 rounds of a Delphi iteration (Green and Price, 2000)

As an example of apparent self-organisation around a replicating discourse the first part of the quote seems classic. Unfortunately we have not yet had the resources to interview many in the industry in this way. We have instead had to take the industry's broadly accepted definition of itself. The BIFM journal (Premises and Facilities Management) now publishes an annual survey of the market by turnover and employees. Table 1 (reproduced from Eley, 1993) lists the companies reported as addressing a December 1992 exhibition / conference of the then 6 'leading' players in the industry. The data in Table 2 come largely from the summer 2001 version of the PMJ survey supplemented where possible by direct information supplied by companies who did not report in the survey but are generally accepted as major players.

For historical data on dates of foundation, dates of entry into FM, dates of mergers and dates of rebranding we have relied mainly on corporate internet sites and, where those are unavailable, approaches to the companies themselves.

As is apparent from both Tables the market has always embraced both companies who provide a range of services using their own employees (or those transferred to them under outsourcing contracts) and those who provide essentially a management service, sub-contracting specific services to second or third tier suppliers.

Table 1. Companies offering totally outsourced FM in late 1992 (according to Eley, 1993)

Company	Staff	Parent	Founded	Main projects
BET	300	BET	1989	Fully independent subsidiary
Drake and Scull	3000	JWP	1987	Engineering / IT moving towards total service
FPM	50	None	1985	Single Building Management
Haden FM	300	Balfour Beatty	1990	Overall Management of Facilities
P&0 TFM	140	P&O Group	1989	Overall Management of Facilities
Serco plc	8,000	ex GE	1987	Government high tech full service. Moving to other users

The data in Table 1 may not be historically accurate (c.f. Table 2) but they do indicate the diversity of entrants and strategies being adopted in the new, or relabelled, market. The largest, Serco plc, with 8,000 employees was formed in 1987 following a management buyout in a company which had originally been formed to provide maintenance and management services to American defence establishments in the UK. They are described (op cit., p.21) as *'not part of the current mainstream of facilities management'*. Eight

years on they head the industry 'league' tables[8] in terms of both employees (32,500) and turnover (£967m). Number two in the 1993 listings, the UK subsidiary of US engineering / IT provider Emcore are reported as having 3,000 employees. They now have 2130 (10th largest, pers comm. to IP) but are in 8th place by turnover[9].

The next two places on the 1993 rankings, at 300 employees each were the subsidiaries of respectively a construction company and an environmental services group. The former was sold to Rentokil in 1996. The latter survives but has been rebranded vis:

> When we consolidated them into one in 1998 we kept the word FM out of the title because bids would come in that were actually asking for single service contracts.

Fifth place (140 employees) was accorded to a 1989 venture by the P&O Group into FM. No record of their fate has been traced. The smallest a 'plc' with 50 employees started by entrepreneurs was acquired by Chestertons in 1994 (property week 17/2/94).

In July 2001, 34 firms with turnovers in excess of £5m featured on the supposedly definitive list which does however exclude others known to the authors. We have attempted to compile, in Table 2, a listing of the majority of entrants to, and changes in, the market in the last 10 years.

Table 2: The developments in the UK FM market place. Current turnover and staff levels are taken from the i-FM listings of July 2001, supplemented where information has been provided by data from companies themselves. Dates indicate the entry of particular firms to FM, or their decision to label their products and services as FM.

Company	Background	Employees	Turnover	Date of entry to FM	Notes
AMEC	Engineering	1345	90		Claim 20 years experience on www.
AMEY	Construction	800	54	1999	New Business Service company floated 1999. Formerly construction co
Aqumen				1997	Rebranding of Mowlem FM
Balfour Beatty Asset and FM	Construction / Engineering			1993	Privatised arm of PSA. Subsequently merged with two other subsidiaries in 1998
Banner	Construction	405	6.5	2000	Rebranding of Henry Boot FM in 2000. Evolved from Planned Maintenance
BET Environmental	Environmental Service			1989	Became Initial. Sold to Rentokil 1996
Building and Property	Govt. Agency			1994	MBO of portion of PSA. Acquired 2001 by Tilbury Douglas and

8 www.i-fm.net

9 The company is not currently listed in the i-FM table. Data provided by them to the authors.

					incorporated in Interserve FM
Caradon					Rebranded as Novar January 2001
Carillion	Construction	2350	77	1999	Tarmac construction relisted as Carillion 1999
CBX					Hived out of Xerox 1995. Acquired by Sulzer 199?
Chestertons	Professional property practice	600	200	1994	Acquired FPM 1994 to enter market.
Citex	Professional property practice	850	55	1998	MBO of Bucknall Austin to launch 'Infrastructure Management' especially concept of 'Corporate PFI'
Coflex	Entrepreneur	174	12.8	1998	New start up by former employees of a large FM company
Dalkia	Utilities / Engineering	1373	90.6	2000	Originally UK heating service. Acquire 1990s by Co generale des eaux (now vivendi) and launched as Dalkhia workplace management
Drake and Scull	Engineering	2130	148	1991	Founded 1987. Moved into FM ca 1991. Rebranded with parent Co Name 2001
Drivers Jonas	Property Service	320	not given	1981	Claim of 1981 is on website. No firm data
Dudley Bower	Building Services			1956	Building service Co entered FM 'in 90s'. Acquired by Aqumen 2000
Emcore				2001	Drake and Scull rebrand, 2001
Eurica	Interior fit out	350	31	1999	Subsidiary of ISG (was Interior Group of Stanhope. MBO 1997)
Europa	Cleaning Services	158	12	1997	MBO and diversification since 1997
FPM	Entrepreneur			1985	Earliest entrant ? Sold to Chestertons 1994
Gardner and Theobold	Property Services	800	54	1998	Listed in i-FM survey but exclusively "white-collar consultancy". Active since 1986 but formal GTFM from 98
Haden	E Services	4,500	180	1998	Founded 1998 in restructuring of Balfour Beatty Group
Haden Building Management				1998	Rebranded by Parent 1998
Haden FM	Building Services			1991	Rebranded by Parent 1998
Henry Boot FM	Construction			1991	Became active in early 1990s. Rebranded 2000.
Initial	Service General	2640	68	1989	Was BET Environmental. Rebranded. Sold 1996.
Integral	Stavely plc Engineering Services			1997	Formed from the amalgamation of five businesses within the Maintenance Division of Staveley (Website)
Interserve	Property	3650	282	2000	New brand launched by Tilbury Douglas after acquisition of B&P
ISS	Service Cleaning	30000	240	1993	UK Subsidiary of Danish Cleaning Company
Jarvis Facilities	Construction	437	201	1996	Owned by Jarvis Plc. In 1997 Jarvis signed the first deal for a LA School and group focus is now PFI
John Mowlem	Construction	770	146	1994	Formally traded from late 1993 when part of PSA acquired. Rebranded

				1997	
Johnson Controls UK	Commercial disposal. Now engineering	1892	206	1995	Took over Procord 1995
McLellan	Building consultancy	631	49		
MITIE	Service Cleaning	1550	165.6	1987	PLC largely employee owned.
Novar				2001	Rebrand 2001. Was Caradon. Based in building management systems
Pall Mall	Construction	230	40	1997	MBO from a general services company. Acquired by Aqumen 2001
Procord FM	Computing			1992	Hived off from IBM. Taken over 1995
Rentokil Initial	Environmental Services			1996	Acquired brand from BET 1996
ROMEC	Commercial HIVE off	5100	165	1989	Still wholly owned by Consignia PLC (Post Office) Being brought to mark. Claim on website to have started 1n 1989
Select	Service Cleaning / other property services	2200	30	1991	Claim on website. Part of OCS Group
Serco	Mgmt buy out	32500	967	1987	See Table 1
Servus	Finance	40	5.8	1999	Servus Holdings and Nomura International venture to outsource corporate property
Stiell	Engineering services	1300	84.5	1996	Following MBO and refocussing
Sulzer	Engineering sServices	850	37.8	1999	Acquired CBX date?. Sold and relaunched as Axima Infrastructure 2001
Symonds FM					No data located. Acquired be G. des eau in 1990s and now incorporated into Dalkhia
Tarmac FM	Construction			1993	Launched as subsidiary division. Rebranded 2000
Taylor Woodrow	Construction	4400	40.5	1998	"Formally founded division 3 years ago after activity for ca 10 year". Seen in industry as active since 1994
Trammel Crow Savills	P Services Property	50	15	2000	JV between Savills and Trammell Crow
Trigon	Property Services			1996	FD Savilla acquiring FM arm of Scottish Hydro
Trillium	Govt. agency	610	206	1997	Founded to take on DSS property 1997. Acquired Land Securities 2001.
Turner FM	Engineering services	1522	53	1992	Owned by Turner Group (Glasgow) Ltd.
Turner Townsend Operations	Consultancy			1994	
WS Atkins	Engineering design	1841	53.7	1998	Purchased Faithful and Gould 1996 and formally launched an FM division in 1998
WSP	Building services / consultancy	170	17	1994	Formally formed when given a contract for Croydon Council outsourcing contract

Limits to the data in Table 2 must be acknowledged. The market is not firmly defined and some companies were reluctant to supply information. It is though clear that it is a 1990s phenomenon (Figure 1). Some of the 1980s claims must be doubted. One 1981 entry is justified by no more than a claim to 20 years experience on a corporate website. Another for 1989 is a similar claim that would surprise most in the industry. Finally, as Eley (1993) notes, Serco, founded in 1987, were only beginning to describe their offerings as FM in 1992.

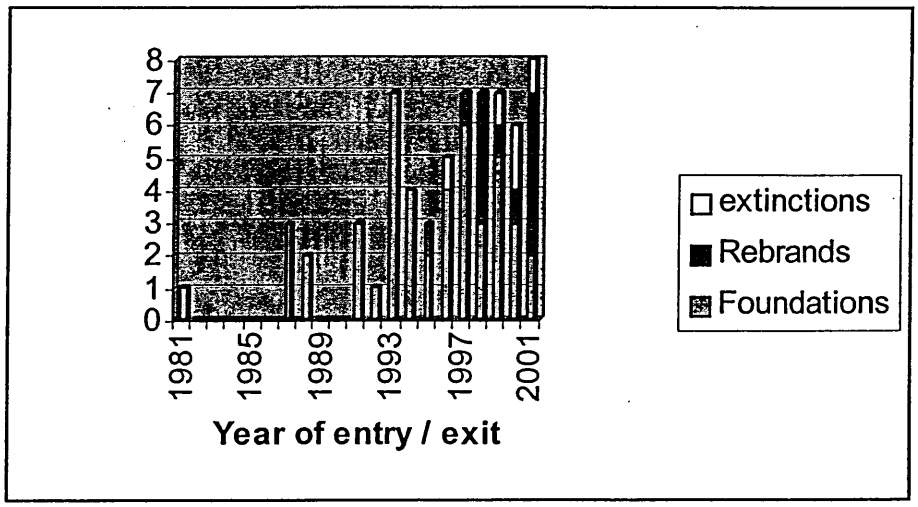


Figure 1. Entry and exit of firms to 'FM'

Again it would be dangerous to draw too much from the data but the rate of entry in the early 1990s and the current spread of rebrands and acquisitions are both consistent with bandwagon effects or 'ripples of chaos' as a replicating discourse, or fashion, runs through a market.

The early wave probably reflects faster IT, reduced transaction costs at firm boundaries and strategic emphasis on 'core competencies', promoting increased interest in opportunities for 'outsourcing' from ca. 1990. Property management, maintenance etc, were prime candidates with both management buyouts (IBM-Procord, Xerox - CBX) and outsourcing to traditional engineering service firms popular. Rebadging as FM providers provided many such firms with a perceived market edge. The recession in construction was a further factor influencing many construction companies to seek to develop business service or FM operations (some achieving by the end of decade relisting as service providers). Government policy was another significant driver, with what came to be

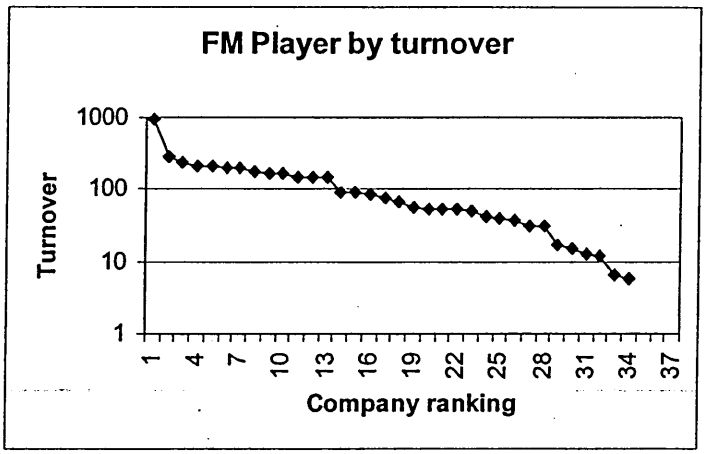
called FM a prime target for CCT and variants. Privatisation of the Property Services Agency (PSA) and other government estate brought other significant players to market.

More recently, with PFI and an emergent market for taking property assets 'off balance sheet', large finance houses and major property investors have sought to acquire an FM capability, though the term itself is under challenge from new inventions such as 'infrastructure management'. Some providers of services are seeking to protect their position by mergers and acquisitions. The question is whether patterns compatible with complexity theory can be detected in what was, in lay terms, an emergent phenomenon.

I.4 ANALYSIS

I.4.1 4.1 Refining the data

Figure 2: FM players ranked in order of turnover.



The general turnover data publicly available are too limited for a full analysis. The ranking by turnover (Figure 2) approximates a log normal distribution, but a full power spectrum of size and frequency could not be shown. We would in any case not predict it if replicating fashions serve to pull a system away from precise edge of chaos conditions. The turnover distribution, while not conclusive, can be interpreted in that way.

In order to make a more rigorous assessment a more detailed dataset was constructed for 25 of the key players, i.e. those with turnovers in excess of £50m p.a. or with particularly high profiles in the new 'infrastructure management' arena. Data was captured from a

plethora of different sources[10] including commercial, market research reports. To protect the companies concerned the full data set cannot, unfortunately, be made available.

Our underlying hypothesis, of isomorphism between biological and cultural systems (Lord and Price, 2001), led us to form the dataset in a manner suitable for a comparison of companies in terms of their postulated memetic similarity. The proposition is that a isomorphic congruence can be analysed and used to help identify 'fitness' within the context of Facilities Management: i.e. the emergent success of an FM player within its social and economic marketplace.

Three datasets were established. The first focussed upon company details, services provided by these companies and the client sectors the services are delivered to. The second focussed upon the service supplier's management and delivery strategy to each of the client sectors and the third provides a market sector analysis appreciating technology, complexity, risk and sensitivity. Full details are summarised in Table 3. Figure 3 illustrates a portion of the encoded dataset.

Phylogram construction requires taxon characteristics to be identified and their states encoded into a computable form. Each taxon (or FM player) is allocated a given trait(s) to reflect true possession as a boolean state. Characteristics have been selected to represent a broad spread of antecedents within the domain of FM. Lapointe and Legendre (1994) used a similar process in their classification of whiskies, without inferring inheritance.

Table 3 – Taxonomic characters assembled for each company

Dataset One – FM Provider 1(a)	**Dataset Two – FM Provider 1(b)**	**Dataset Three – Market Sector**
Company Details Ltd / Plc Status	**Core Market Sectors** Construction	**Service & Business Analysis** Technology (H/L)

[10] FM Market Analysis Reports including: Barbour Index FM Market 2000; Premises & Facilities Management Analysis Reports 1997, 1998, 1999, 2000; CFM FM Market Report 1999; Audit Commission FM Market Analysis 1999; AMA Research UK Facilities Management Contractors Market Report 2000; IFM Market and Company Survey Reports 2000; Mintel Research FM Market Report 1996-2000; Plimsoll FM Analysis, Profit Predictor February 2001; IFM Market & Company Survey Reports 2000; Recognised Datastores (eg) UK Kompass, US Hoovers; Individual Company Websites and Interviews (where appropriate).

Year Established Parent / Subsidiary Turnover (£m) Pre-tax Profit (%) Employees (nos) Management (%) Technical (%) Operational (%)	Support Services Other Services	Complexity (H/L) Risk/Business Sensitivity (H/L) Innovative Core Competence Necessity Commodity
Services Provided Bldg Operation & Maint Support Services IT & Comms Transport Property Management Infrastructure Environmental Mgmt	**Services Provided** Management Level Low (Service Provider) Mid (Mgmt Contractor) High (Managing Agent) Exec (TFM Provider)	**Services Provided** Bldg Operation & Maint Support Services IT & Comms Transport Property Management Infrastructure Environmental Mgmt
Business's Served Manufacturing Retail Finance Construction Hospitality Transport Computing & Comms Pharmaceuticals Government Education Health & Welfare Defence Utilities FM Other	**Services Provided–Mmgt Level** Bldg Operat & Maint Support Services IT & Comms Transport Property Management Infrastructure Environmental Mgmt **Delivery of Services (%)** **Mgmt of Service Delivery (%)** **Delivery & Mgmt of Service (%)**	**Business (Market) Analysis** Manufacturing Retail Finance Construction Hospitality Transport Computing & Comms Pharmaceuticals Government Education Health & Welfare Defence Utilities FM Other

CHARACTERS - SET ONE (B8:IS27)

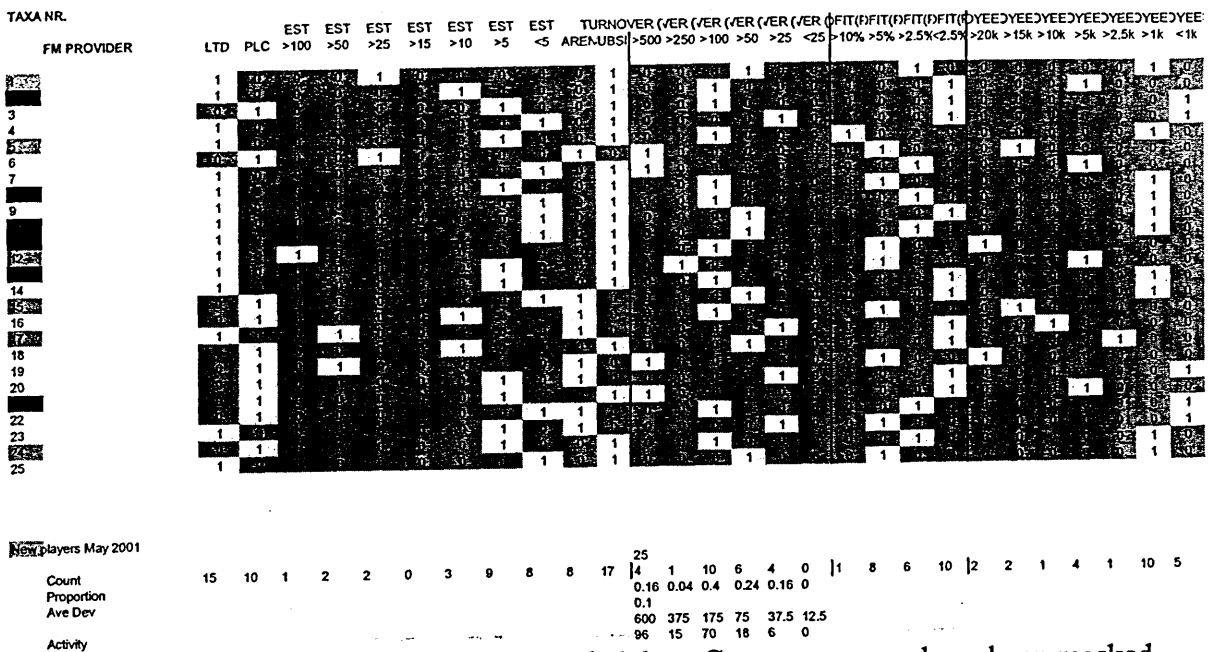


Figure 3. An example of a component of coded data. Company names have been masked,

I.4.2 *The fitness landscape*

With data on turnover and market share by service category and market sector, it is possible to map the landscape of the market (Figure 4). The graph is scaled such that the total volume under the surface corresponds to 'market size': i.e. the turnover of the main players. Each node then indicates the share of the market occupied by a particular service in a particular sector.

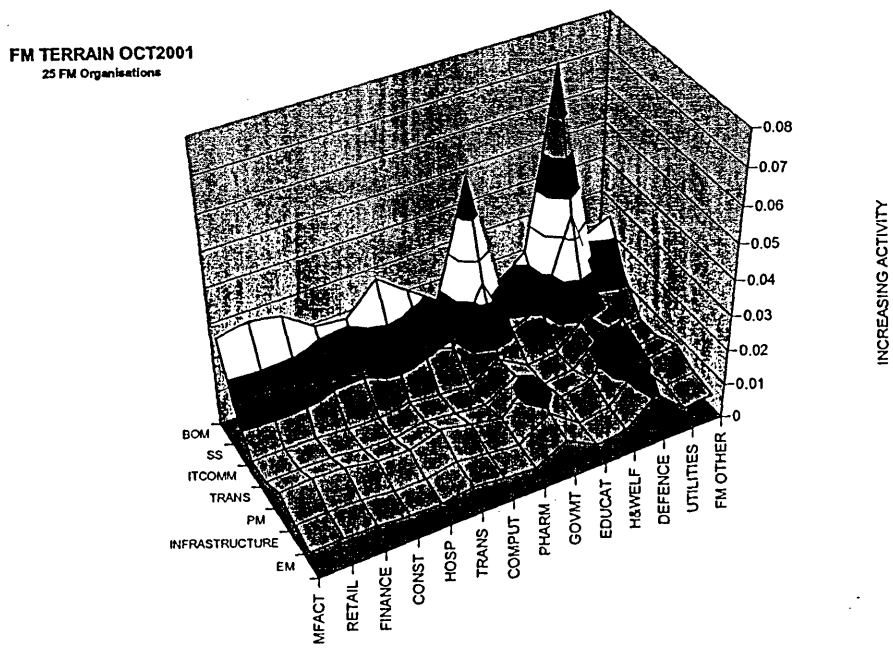


Figure 4. The fitness landscape of the FM Market

The result is a landscape dominated by one major peak centred on defence and building operations / maintenance and a general ridge for the same service. Smaller peaks occur along both the defence and maintenance axes. While the form of the landscape is, to some extent, dependent on the choice in which service and sectors are ordered the visual pattern remains. The overall market is skewed to one service and certain sectors, rather than showing either a completely chaotic or a single peak structure. The distribution is again consistent with the predicted property of a system verging towards, but not resting at, an edge of chaos condition.

I.4.3 Strategic phenotypes

MENDEL[tm] is a bespoke tool for reconstructing hereditary and lineage in sociological entities from their traits, using algorithms adapted from numerical taxonomy. The software has been implemented within the Microsoft Excel dialect of Visual Basic for Applications (VBA) that allows a conventional spreadsheet interface to be populated with a matrix of tax - character states[11]. The featured coefficient of similarity is the *Hamming distance*, which provides an absolute metric of digital error and *unweighted pair-group method using arithmetic averages* (UPGMA) as a clustering strategy of minimal complexity (Sneath & Sokal, 1973). The clusters are plotted as a phenogram, which may be reinterpreted from the cladistic perspective as depicting organisational descent. MENDEL was initially tested on genetic algorithm generated data and later successfully reconstructed the emergence of Christian denominational families (Lord and Price, 2001)[12].

[11] A.K.A. Boolean Encoded Meme Strips (BEMS)

[12] Note added in proof. The software has been reviewed in the Evolution and Evolutionary Computation Symposium of the EPSRC Network on Evolvability in Biological & Software Systems (University of Hertfordshire, Feb. o2)

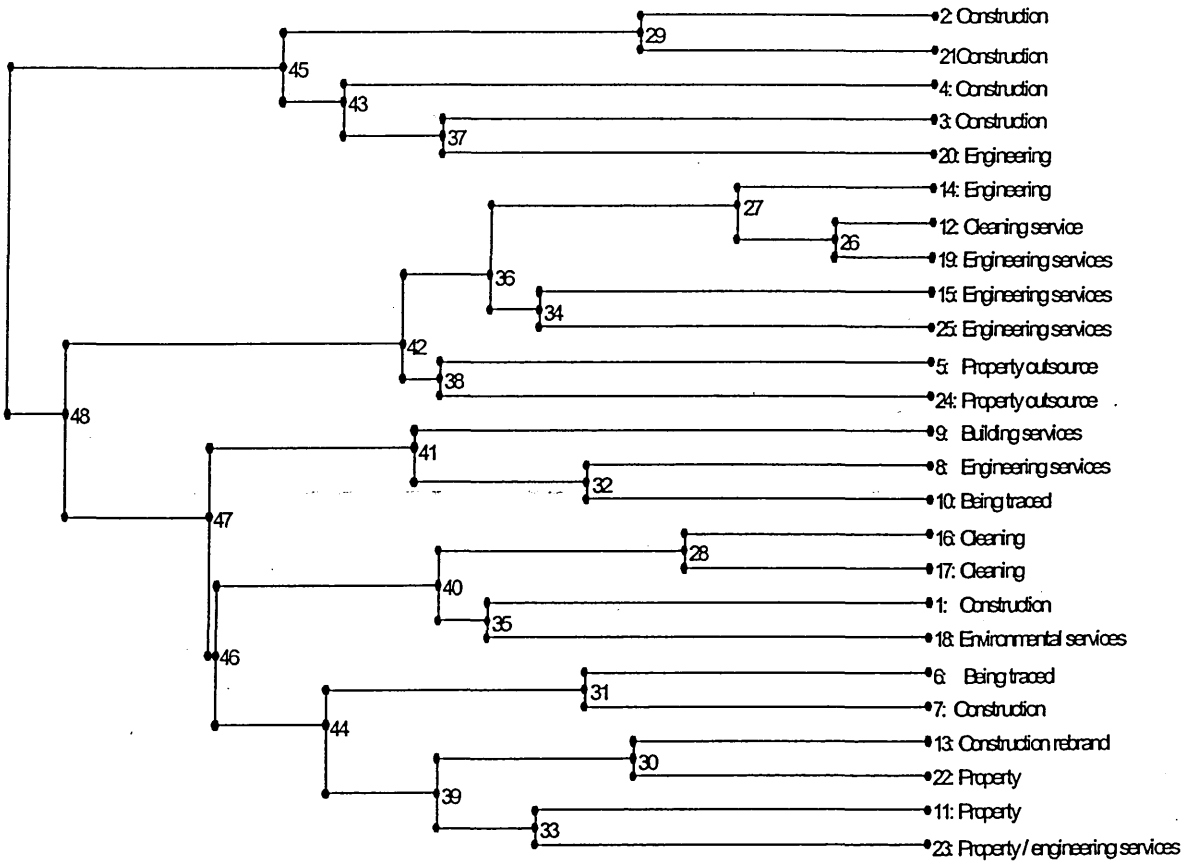


Figure 5: The landscape of the market occupied by the 25 largest players in UK FMA memetic phenogram of the 25 company data set. Pairs show most similarity. The clustering of groups with similar ancestry is generally apparent though one or two players appear to have successfully departed from norms. Further work to investigate these is planned.

Characterising the belief systems and 'institution' of firms is more complex. We took instead the assumption that market position and services offered - the data set for Table 3 - would either be a function of the overall strategic paradigm or mindset (c.f. Price and

Shaw, 1998 for the argument) or might reflect the need for particular competencies in particular niches. Comparisons (Figure 5) do indeed produce clusters of firms from similar industrial backgrounds suggesting that strategic recipes have transferred across or that competencies needed in one market translated to a new one. The fact that not all players from the same background now occupy similar phylogenetic groups, and one or two appear to have successfully invaded new niches, is more easily explained if the limit

is configured as 'recipe' -strategic mindset- rather than as a problem of necessary competence.

I.4.4 r' and 'K' strategies

Behavioural ecologists observe two fitness-increasing strategies: the 'r' and the 'K'-. The former is characterized by a high rate of propagation. It occurs especially with species specializing in colonizing new habitats with variable conditions or in species with strongly fluctuating population sizes. The K-strategy, in contrast, describes a regulated, density-dependent propagation where population sizes approach the carrying capacity of a habitat (denoted as K). It occurs in species living in stable habitats, where a high rate of propagation is of no advantage. In nature, all conceivable transitions between these two extremes do of course occur. Organizational scholars concerned with evolutionary explanations of strategy and behaviour have postulated the same trend with new markets favouring r-strategies (high rates of entry and experiment) while maturing markets favour K-strategies (size, competency, and if possible the creation of entry barriers).

The two phases can be seen at work in FM. The early 1990s saw both entry into the new market by firms from a variety of backgrounds, and a rush to rebadge existing services with the new 'buzzword'. The last few years are seeing the competition to be one of the main players with the financial and professional capability to combine property ownership, property operation and frequently construction; a strategy verging towards the 'K' end of the spectrum.

I.5 CONCLUSION

We have sought to identify the entry and exit of firms in a rapidly evolving new market. The result, after ca 10 years is consistent, not with pure edge of chaos models, but with the hypothesis that markets have a tendency (driven by self-replicating schemata or memeplexes) to self-organize toward stability, or at least the illusion of stability. The distribution of players is consistent with such a hypothesis, as is the landscape defined by an analysis of the market. The positions of individual players can be interpreted as reflecting, in the majority of cases, the patterns of thinking they inherited from their parent industries. A smaller number of players seem to have escaped these patterns. As

the market has matured, a trend from r-strategies to K-strategies seems to be occurring. All these observations are consistent with the proposition that evolving markets are memetically influenced complex adaptive systems. The case appears to demonstrate the power of that approach to the analysis of other market sectors.

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Appendix J: The distant future

> When we have progressed enough to explain ourselves in these mechanistic terms, and the social sciences come to full flower, the result might be hard to accept. – [Wilson, 1975 p575]

This research has dipped into depths of time, of cosmogony, natural history and management study. It has also taken a synchronic snapshot of the contemporary memetic ideas, arguing that transition from theory to practice is long overdue. This appendix goes the other way, briefly looking into the future, to what I have termed era 3 and beyond, to the potential consequences of memetics and considering what is lies past passively trying to understand the meme. The following speculations are intentionally provocative thought experiments[1]; the inevitability and desirability of them are highly debatable.

J.1 Organisational memome project

The research herein as looked at a restricted set of characters for a narrow set of bodies within a singular organisational form. Aldrich (1999) has warned of large-scale studies.

> Systematic study of large numbers of organizations over long periods of time would tell us much about the independence of routines and competences, but such research is costly and time consuming – [Aldrich, 1999 p40]

However, in the future it may be possible to envisage the full extent of abiodiversity and like biodiversity, the real numbers may dwarf our current estimates. From this, and analogously to the human genome project, a full map of the organisational *memome* may be eventually derived by which the locus of all organisational traits are known.

[1] And do not necessarily represent the opinions of the author!

J.2 Recombinant Meme Engineering (RME)

Recombinant DNA technology (AKA genetic engineering) has enabled the creation of new transgenic organisms though the deliberate recombination of their genes. Again, the isomorphic proposition has meaningful inferences for wilfully crafted memeplexes. The meme mapping method, rudimentary in its present state, suggests a means of encoding memeplexes. Such a codification also allows novel meme strips to be envisaged and it may be possible to develop methodologies such that memetic software can be authored to meet exacting cultural specifications. Scripting new memeplexes could well involve cutting and splicing sub strips from many existing memeplexes and whole libraries of memetic software objects, whose expressions are known, may eventually become available. The technology of RME would provide the ability to engineer conceptual, cultural or corporate chimera.

J.3 Cliology

Science, as an attempt to comprehend nature's mechanics, usually heralds technology as the imperative to harness the forces of nature. Deterministic and ethical conundrums aside, a similar naturalistic understanding of cultural systems means that we no longer stand passive, as observers, helplessly watching and becoming assimilated into historical narrative. We realise that we can become players who, unlike King Canute the Great, have the technology for redirecting the tides, cultural in our case. Such ability would push Price and Shaw's (1998) 5th attribute to its logical extreme. *Cliology*, named after the muse of history[2], may well be an appropriate name for neo-positivist conciliance between the humanities, the natural sciences and our specie's urge to manipulate its environments[3]. Cliological ideas are not new: Tarde (1903) raised the possibility that successful imitations may be engineered; Westoby (1994), Brodie (1996) and Lynch (1996) make similar allusions using the term meme; and in science fiction Spinrad (1991) and Flynn (1990) make the consequences explicit.

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[2] Suggested here after Flynn (1990) – see quotation at front of part 4.

[3] Auguste Comte (1798-1857) said that sociology would be the last theoretical science to reach the positive stage; Quetelet (1796-1874) coined the idea of social physics; and Henry Thomas Buckle (1821-1862) searched for the laws of civilization. While these ideas were in the positive vein, Cliology may consider social engineering subject to neo-positivist caveats as suggested in part 2.

J.4 After word

As with all inventions or developments, it is their application that needs ethical consideration. If the memetic stance is valid then, irrespective of this research, a technology of memetics will become available. The ethics are on a par with those of human genetic modification though less easy to envisage. The ultimate extrapolation of meme theory is way beyond the bounds of the current research; ignoring the ethics on academic grounds won't make the problems go away and warnings should be heeded or at least appreciated now. The researcher's aspirations in anticipating a memetic technology are noble, it is easy to see though, how such a technology may degenerate into abuse: a weapon of social oppression, mass control, *eumemic* propaganda and a structured blueprint for building dystopia; perhaps to an extent that would make the heinous atrocities of the 20th century seem amateurish.

Should access to memetic technology be jealously guarded so as not to "fall into the wrong hands" or should it be made public domain? Such a dilemma tends to challenge one's moral certitude. Social Darwinism serves as a cautionary tail. As a meta-comment to part one (§1.2.1.3.2), I would suggest that the memeplex of Social Darwinian contained fallacies at numerous loci (eg. with progressivism) such that its actualisation could become violently pathogenic. Since then, naturalistic orientations to social systems have been brushed under the carpet and it has become academically fashionable to frown on those who go anywhere near them – a cleaver trick[4], but numbing inquiry is every bit as repulsive as the potential downsides of permitting it.

Memetics is engendered with a kind of self-awareness with the paradoxical implication that memetic technology may be used to bootstrap memetic technology. It may therefore be possible to construct a technological memeplex that upholds ethics through parity correction, idiotropic scents, selective uptake inhibitors[5] and so on.

By way of example, Alfred Nobel's foundation promotes the sentiment, symbolised by dynamite, that discovery, technology and the harnessing of power should be turned

[4] In my opinion
[5] To ensure that certain groups will reject the idea.

towards the service of mankind. More importantly *Nobel* constitutes a meme – an ethical canon - to inspire (or at least infect) future memetic engineers who will tag it onto their own carefully sculptured memes. Least we reiterate Kenneth Bainbridge's[6] statement that '*Now we are all sons of bitches!*'

[6] "Trinity" Test Director on the Manhattan Project
http://www.childrenofthemanhattanproject.org/COTMP/quote_submit.htm

Appendix K: Hertfordshire Presentation

EPSRC Evolvability in Biological & Software Systems:
Software Evolution and Evolutionary Computation Symposium

MENDEL and EDEN: Exploring evolutionary pathways in socially constructed systems

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Memetics, drawing on Dawkins (1976) suggestion of the meme as a unit of cultural replication, has begun to support a body of scholastic investigation into evolving organisations considered as the memetic 'phenotype' (Price, 1995; Gell-Mann, 1996; Price and Shaw, 1998; Williams, 2000). If organisations evolve (Aldrich, 1999) evolutionary pathways should be testable by comparing their 'memetic' characteristics and precisely what aspects, if any, play the 'memetic' role is, in principle analysable. In biology molecular phenetics, the comparison of genetic similarity between species, shows an ability to reconstruct cladograms, classifications based on descent from common ancestors. Our concern is with a methodology for drawing comparable classifications in organisational milieu. MENDEL[1tm] was developed as a bespoke tool for reconstructing hereditary and lineage in sociological entities from their traits using algorithms adapted from numerical taxonomy. The software has been implemented within the Microsoft Excel dialect of visual basic for applications (VBA) that allows a conventional spreadsheet interface to be populated with a matrix of taxa - character states. The featured coefficient of similarity is the *Hamming distance*, which provides an absolute metric of digital error and *unweighted pair-group method using arithmetic averages* (UPGMA) as a clustering strategy of minimal complexity (Sneath & Sokal, 1973). The clusters are plotted as a phenogram, which may be reinterpreted from the cladistic perspective as depicting organisational descent. MENDEL was initially tested on genetic algorithm generated data and later successfully reconstructed the emergence of Christian denominational families (Lord and Price, 2001).

A cluster of firms entering a new market during the 1990s have been shown (Lord et al. in review) to, in the main, cluster in a manner that reveals common parentage. Tests are currently underway to whether definitional stances to the term obsolescence applied to buildings, in published literature, reveals a phylogeny which has any correspondence to institutional and professional descent. Further opportunities to test the method, and develop applications for non-binary data are being sought.

A parallel development EDEN-ML initially served as a test harness for MENDEL by evolving synthetic *Binary Encoded Meme Strips* for reconstruction. Further developments of this module are planned. These will include the ability to explore combinatorial meme space thereby finding uninhabited peaks on a fitness landscape and to navigate an optimum path between peaks.

The practical organisational application of these enhancements is the provision of insight into future market direction, which acts as a basis for business strategy and structuring. As information systems are inexorably linked to business needs then anticipation of change can assist in establishing software requirements. Tracing and simulating memetic evolution, using MENDEL and EDEN-ML, may therefore contribute to more effective software systems development methodologies.

Appendix L: Memetic perspectives on religion

Within the field of theology, the existence of religion makes perfect sense. Science on the other hand, demands a natural explanation for supernatural belief. In spite of anthropological, psychological, sociological attempts at explaining why so many people should adhere an essentially anti-scientific worldview, from the scientific perspective, religion remains a perplexing and intriguing question.

Evolutionary psychology particularly, envisages such sociological traits as religion and notions of God as survival adaptations[1]. Reynolds and Tanner (1983) have considered the biology of religion pointing to the relationship between religious practices, attitudes to sex, disease & death, survival and reproductive success, and *per capita* energy consumption. Gottsch (2001) points to its naturalistic origin.

> At some point in human evolutionary history, self-awareness created a void in humans' interpretation and understanding of their world. At that juncture, the species needed answers to alleviate fears and anxieties arising form awareness of the unknown and death. The god concept filled this void. With the advent of writing some 6000 years ago, the specifics of god and the relationship between humans and god began to take on a permanent indelible form. – [Gottsch, 2001]

The memetic stance takes evolutionary principles one-step further but rather than being beneficial to the host, focuses on advantages for the idea's survival. More graphically, the "virus of the mind" (Brodie, 1996; Dawkins, 1993) metaphor provides a minimalist explanation in that belief don't necessarily have to be true, rational, sensible, verifiable or for that matter beneficial to anyone in order to gain wide acceptance. It is sufficient that a belief has such a structure that enables replication between minds. The idea of memetic parasitism offers a scientific reason for the widespread acceptance of irrational and possibly detrimental, religious faith (Lynch, 1996).

The Christian mission is inherently to proselytise faith. Throughout the gospels and particularly the resurrection, Jesus urges his disciples to spread the Word for example:

> "Go into all the world and teach the good news to all creation. Whoever believes and is baptised will be saved, but whoever does not believe will be condemned." (Mark 16:15).

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[1] Although some Christian literature has used the word "evolve" to imply "progressive changes" within the church this has obviously been used without connotations of Darwinian natural selection.

The inherent demand for witness, along with staggering growth of evangelical sects (see University of Virginia site[i]), suggests that the Christianity has all the hallmarks of an almost purely memetic phenomenon. Fog (1996) suggests.

> Certain memes in such a meme-complex are *hooks* which make the entire set of beliefs propagate by providing an incentive for the believer to proselytise. Other memes in the complex makes the host resistant to infection by rival beliefs. The belief that blind faith is a virtue has exactly this function. - [Fog, 1996 p28]

Viewing religion from the point of view of virulence has been an endless source of fascination (and amusement) in memetics and various aspects have been explored by many of the pioneers of the subject. Perhaps one of the reasons why meme theorists are attracted to analysing religion is the irony that natural selection is used to explain the popularity of creationism. Dawkins has traditionally (1976) held a dim view of anti-science and as a hardened neo-Darwinist, particularly rejects creationism[2]

> Memes for blind faith have their own ruthless ways of propagating themselves. – [Dawkins, 1976 p213]

He brings direct attention to the memetic nature of religion as a particular vehicle for propagating faith (*propaganda fide*).

> Perhaps we could regard an organized church, with its architecture, rituals, laws, music, art, and written tradition, as a co-adapted stable set of mutually-assisting memes. - [Dawkins, 1989 p197]

Dawkins (1993) takes the hard-line view, which some in the Church may find offensive, that religious faith is essentially a pathological infection. More provocatively he imagines how a medical textbook might describe the typical symptoms of a sufferer from a religious virus. Ironically, it has been pointed out that Dawkin's polemics actually assist with the spreading of the meme of the bible (Piper, 1997).

Another favourite topic among meme theorists is the notion of suicide and violence whereby the importance of human life is secondary to a memes demand for replication (Marsden, 2001). Auto-destructive memes frequently converge at the extremities of religions fundamentalism whereby the resulting "socio-pathogen"[3] contaminates a sub-culture, ultimately consuming its fanatical adherents. Most graphic are the death cults that periodically provide a media circus. Textbook

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[2] Creationists have reciprocally held a dim view of Dawkins (Yahya, 2000).
[3] "Theopathy" may indicate a religious by-product

examples are Heavens Gate, Aum Supreme Truth, the People's Temple of Jonestown, the Branch Davidians of Waco to name a few[4]. (Moran, 1999; Singer, 1995; Hassan, 1998).

Though "cults" exhibit disturbingly close analogies to viral infections, Cullen (1998) contends that established religion's mutual dependence on humans disqualifies it from being considered a "disease"

> Vertically transmitted religions, like vertically transmitted viruses and other parasites, should evolve towards symbiotic or benign states. ... if we are to find a truly pathological religion, we will have to look for examples where the pattern of transmission is horizontal, or essentially indiscriminate with respect to genetic relatedness of new recruits. – [Cullen, 1998]

The wilder and more creative fringes of religious memetics, of course, are to be found lurking on the Internet. ChristianityMeme.org[ii] does a thorough job of explaining theology in the language of memetics. The *holy salvation meme*[iii] (Erwin, 1994) stretches kerygmatic hyperbole by condensing Christian soteriology into the superstitious promises and threats of a virulent e-mail chain letter. Barnett (1999[iv]) examines religious evolution and uses this to provide a recipe for "making your own religion"[5]. The "Church of Virus"[v], a memetically engineered atheistic religion, satirically goes one step further by having its own list of sins and virtues (it even goes so far as to canonise Darwin!).

Though meme theorists understandably gravitate to the Darwinian camp in the ceaseless war against dogma, meme theory (like natural selection), in itself, is inherently unbiased. Meme theory offers no more than a neutral explanatory device as

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[4] Tragically, while writing this section terrorist hijacked passenger aircraft have ploughed into and demolished the World Trade Centre (September 11th 2001) and part of the Pentagon killing thousands. Islamic fundamentalists are suspected to be responsible for the suicide attacks on the USA symbols of wealth and power. Dawkins made immediate comment in the Guardian (15th September, 2001) claiming that such a theocracy would not have the technological sophistication to mount an attack of this scale. The strike relied on the mindsets of expendable suicide commandos, which pivoted on the religious teaching of martyrdom. According to Dawkins, the nonsense doctrine that "life is not the end with death" devalues life itself, making religion to blame for Tuesday mornings attack. *'To fill a world with religion, or religions of the Abrahamic kind, is like littering the streets with loaded guns. Do not be surprised if they are used'* wrote Dawkins. The notion of suicide terrorism was subsequently examined (Marsden, 2001) with respect to the Werther effect.

[5] The Scientology and Dianetics of science fiction author L. Ron Hubbard almost constitute a "designer religion" and were examined in the early stages of the research. Cultic cases outside the mainstream of Western Christianity, however, were omitted from the final analysis for reasons previously explained (§3.3.2)

to how religion may arise and how cultish and pathological extremes may be derived[6]. The notion of the blind replicator, subject to Darwinian selection, is an '*ontologically minimalist heuristic*' (Marsden, 1998a) and it is this which gives the memetic view of religious social phenomena explanatory power over pre-existing theories and theologies.

An intriguing twist on meme theory comes from of post-modern theology's recombination of religious and extopian[vi] principles. Evangelist Leonard Sweet (2000[vii]) sees that acknowledging religion's memetic underpinning allows religion to return to its original form thereby leading people to Jesus *'The Jesus Meme is not a possession you wield, but a life you yield'*. On a similar note, Hugh Piper (1997) envisages that *'Somewhere in this may be a dynamic that can lift us beyond the mechanisms of the meme and into true encounter'*[7].

Contemporary memetic thought has turned from attacking blind irrationalism towards a serious attempt at understanding the mechanisms of the origin, development and propagation of religious faith systems. Piper (1997), presenting at the *Bible into Culture Colloquium*, examined scripture from the view of the *Selfish Text.* Interestingly, this theologian turns to Dawkins, notably the fiercest critic of the biblical worldview, to provide a Darwinian explanation as to why the bible represents one of the most successful texts ever produced.

> In art, literature, politics and religion, biblical thought-forms, narratives and quotations are all-pervasive. As Western culture becomes globalised, so too does the bible. It is said that between a quarter and a third of all Japanese households possess a bible, in a country where only one or two percent of the population have any Christian adherence. This is because it is regarded as essential background for a proper understanding of Western culture. – [Piper, 1997]
>
> The argument we will pursue is that in this sense, the bible is indeed an active replicator, one which alters its environment so as to increase its chances of being copied. The intriguing questions then become how the bible alters its environment to increase the likelihood of its being replicated and why it has been so conspicuously successful in this. – [Piper, 1997]

A fit replicator, owing to geometric population growth, would account for success in terms of numbers. Scripture, if a replicator, is obviously non-genetic:

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[6] Such a naturalistic explanation is, of course, the real antithesis of blind faith.

[7] Indeed, Pope John Paul II has stated that the Roman Catholic Church does not have any objection in the teaching of evolution to its children. He stated, that as long as the spiritual soul of man emerged from the living building blocks that God created, then the Church has no objection to the physical voyage that man has travelled (Pontifical Academy of Sciences meeting in Rome On October 22, 1996)

> The bible if anything seems more like a repository of memes than a meme itself or even a 'meme complex'. – [Piper, 1997]

Whether the bible is a repository or a memeplex, to use Blackmore's (1999) term, or a bit of both, is open to debate. The point is that taking the memetic stance opens the bible up to the identification of its memetic characteristics essential for survival – scriptural examples of these characteristics abound, either literal or allegorical (e.g. Mat, 28:19; Mark, 1:17, 16:15; Luke, 24:47)

> The bible must be read and must make itself read if there is to be reproduced. Its success in achieving this is what makes it an example of a highly adaptive active replicator. ... The book itself encodes memes which once active in the mind lead the human agents of that meme-pool to produce more examples of the text. – [Piper, 1997]

Piper asks as to why anyone would ever want to read the bible (and make copies) in preference to reading or doing other, more directly gratifying things. How has scripture, in other words, elevated its own importance over materialistic human needs? In modifying Dawkins' (1993) term 'Virus of the Mind' to produce the idea of 'the viral bible', Piper suggests that:

> Such a meme will have to instil in the host a mechanism of conserving the meme, and a mechanism of for propagating it. ... [along with a] mechanism of conserving its variability so that any changes in the environment, including the intrusion of other foreign memes, and in particular any developments in the host's own immune system can be either countermanded or else outflanked – [Piper, 1997]
>
> My tentative suggestion is that the bible instils a meme in its readers which aligns its own survival with that of the reader and his or her community. 'Your survival depends on mine' is the message that the bible gives. – [Piper, 1997]

This seems to follow the evolution of cooperation (Axelrod, 1986) to the extent of mutualistic symbiosis or uneasy co-dependence. An interesting point behind Christian scripture is a variation in which "Your *soul's* survival depends on mine". Sufferance in this life is a test of faith and death a gateway to the beyond[8]. Salvation, eternal bliss (or damnation)[9] is contingent upon faith in the content of the text. John testifies this:

> For God so loved the world that He gave His only begotten Son, that whoever believes in Him should not perish but have everlasting live (John 3:16)

Piper explains the "symbiotic" strategy behind the *holy salvation meme* (Erwin, 1994[viii]):

> Christianity has adopted the alternative strategy of a promise of immortality, in that the believer's death is caught up in the context of the resurrection of Jesus. ... together with stern warnings of the likely outcome of failing to abide by the word of the text. – [Piper, 1997]

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[8] Pascal's wager http://www.ucs.mun.ca/~alatus/Intro/CT1PascalsWager.html is a variation on the prisoners dilemma which has a metaphysical payoff matrix.

[9] One of the best variations on this theme I have seen was one of those day glow slogans outside a church that read '*exposure to the son can prevent burning*!'

It is noted however; following Axelrod (1986) and Dawkins (1989) that mutual co-operation between symbionts is for maximal self-interest and devoid of altruism. The relationship is one of temporary convenience.

> It is quite possible that an organism will live quietly as a symbiont and then suddenly turn on its host at a later stage.... From the invader's point of view, this matters little as long as it achieves its goal of its own reproduction.– [Piper, 1997]

So as far as biblical memes are concerned (to anthropomorphise them) their own replication, and therefore immortality, that is paramount:

> Both genetically and memetically, the afterlife of the believer is strictly irrelevant except in so far as belief in personal immortality act to sustain the continuity of the meme pool – [Piper, 1997]

Fecundity is one factor in a replicator's success; longevity and fidelity are others. Scripture has built in immunity against infection by other memes, which can be seen in the alleged fidelity of the bible (note that 'fidelity' is etymologically related to 'faith'[10]). Various (if conflicting) claims of biblical inerrancy (Sproul, 1995) constitute a component of the bibles replicative memeplex as being the inspired word of God.

> The bible contains powerful instructions as to its own unique worth and the limits to be placed on the infiltration of foreign information or texts into the communities which propagate it. The whole process of canonisation, for instance, reveals a complex interaction between text and community which serves, for example, to oust the fledgling apocrypha and turn the community's attention to the ever-growing task of copying and commentating on the biblical text with an increased sense of its importance and of the need for its conservation. – [Piper, 1997]

Although minor duplication error may have crept into the text during early translations memetic variance doesn't come from the main text[11]. The drive for the conservation of Gods perfect word through canonisation[12] has conferred the bibles relative fixity. Variance however is enabled through the context[13].

> Furthermore, even in its canonical form the bible can still generate variety. The information contained between the covers of any given edition the bible varies and develops, especially in terms of marginalia and commentary, which may, at times, have outweighed the biblical text in terms of importance. It is only necessary to count the number of editions of the bible currently available to realise how in adapting to the needs

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[10] As will be seen, the notion of *sola fide* (salvation by faith alone) was central to the reformation

[11] The Jehovah's Witnesses *new world translation* on the other hand, is an entire rewriting to reflect their Christological position of Arianism; their justification being the claim that that their translation is more faithful to the original scripture than standard bibles.

[12] Canon is from the Greek *kanon* (originally from Egyptian) meaning "reed" or "cane" used by the ancients to ensure correct measurements in masonry. Theologically it denotes the setting of a fixed standard by which authoritative scripture is determined.

[13] Parts that appear literally *with the text* and fix the referential frame of meaning. The term *context* will be used here, however to denote the interpretive framework, whether accompanying scripture or separate, spoken, implied or otherwise.

> of different communities, cultures and age groups, the contents of the physical entity called the bible can vary widely. These variations serve to widen its appeal, or in other words to enable it to gain entry to and propagate itself in a whole variety of new environments. – [Piper, 1997]

Even where the text has stabilised, then ambiguities[14] lead to multiple interpretations, depending upon the interpretive context, can justify all manners of behaviour. Considering that the context may be consistent *within* yet vary *between* communities then it is not the sacred text itself (as the essentially immutable canon) but rather the hermeneutic context that may give rise to expressed differences between communities of practice.

> So too the bible contains more information than any one community can readily assimilate, especially as it may seem mutually contradictory or impossible to apply in a given situation. What then happens so often is the formation of a canon within the canon, where the community opts to read and follow a particular smaller set of instructions, read with a particular interpretative slant. This may change over time, giving a flexibility and yet continuity to the community. Biblical communities themselves show a capacity for survival which consists in a knack of maintaining continuity through change. – [Piper, 1997]

Interpreting this from the memetic stance then holy-scripture becomes a memetic structure that is necessarily *bradytelic* (slowly evolving) on the grounds that it is "the eternal word of God". Parochial hermeneutic context, on the other hand, has no such enforced fixity and may be open to argument. Alternatives may be seen as unorthodox but not heretical as they are not at the core of Christianity. Variance here suggests a *tachytelic* (quickly evolving) memeplex. *I conjecture that variation, selection and replication acting predominantly upon the hermeneutic contextual memeplex is giving rise to diversity within the family of Christ.* This is particularly in evidence where the claim to universal spiritual authority of the bishop of Rome was challenged during the reformation. Rejection of papal infallibility served to de-monopolise interpretation of scriptural evidence consequently introducing pluralism and hence variability into the context (§3.4.7.2).

> A prime exemplar of the selfishness of the text might be seen in the reformation where the text operates to cause a major breach and disruption in the community which sustained it in order to take advantage of the new technology of printing through the propagation of a meme that removed the authority of interpretation from the institution to the individual and to the possibilities of reproduction within vernacular language communities. – [Piper, 1997]

Variation in context enabled the bible to colonise new niches while preserving the core scripture to a greater extent.

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[14] Termed by Price (private communication) as a *selfish signifier* whose multiple meaning contributes to its fecundity.

> It is patently a fallacy to argue that the bible provoked the Reformation in order to increase its own population, but the facts remain. Whatever damage the Reformation did to the church and to the victims of the religious wars that accompanied it, it was certainly good for the bible. – [Piper, 1997]

To use a relevant metaphor, it is as if scripture is a nucleus protected inside an adaptable shell that can shield it from any hostile environment. Interestingly, Piper notes that the bible remains fit even in the prevailing climate of secularism. Indeed even irreligious, atheistic or anti-biblical renderings serve to promote the spread of holy-scripture.

> Having formed communities about itself for two thousand years, often by coopting its enemies, is the bible proving able to do this again by infiltrating not religious but cultural discussion?
>
> A telling example of this ability of the biblical text to infiltrate the most unlikely communities is the very genre of popular genetic writing of which Dawkins is the most celebrated practitioner. ...It would be ironic, would it not, if we were to conclude that Dawkins himself has become a 'survival machine' for the bible, a 'meme nest' for its dispersed memes which may induce readers who would otherwise leave their bibles unread to go back to the text. – [Piper, 1997]

Scholars of memetics, it would seem, tend to make particularly good, albeit unwitting vectors for the biblical memes[15].

Pitt, (1998)[ix] views *the memetics of monotheism* and points out the struggles and the influence of power in the development of theological memes thereby rendering the means of control of "information capital" as a component of the class struggle[16].

> The Bible is a long record of ideological and physical struggle. It is worth studying in spite of inevitable omissions, distortions and mistranslations.
>
> Since the environment of the rich and powerful differs from that of the poor and weak, successful ideas may differ in the various classes. The material power of the rich to support or repress ideas must also be taken into account. Hence I believe that the Marxist approach is essentially correct. – [Pitt, 1998]

Pitt's (1998) considers that a powerful minority attempt to control the hearts and minds of the masses through *conceptual downsizing* in the name of the ultimate authority (Thompson, 1985); or famously

> Religion is the sigh of the oppressed creature, the heart of a heartless world, just as it is the spirit of a spiritless situation. It is the *opium* of the people. – [Marx & Engles, 1957].

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[15] Which thwarts my agency in this dissertation!

[16] This, to my mind seems to be an attempted hijacking of the meta-meme by the Marxist meme through idealisation and identification with the material dialectic. A similar occurrence was through Marx's dedication to Darwin in *Das Capital.* My view is that memetics is incompatible with (though not entirely dissimilar to) Marxism as it suggests that the Darwinian struggle is between memes not economic classes.

Being a political perspective however, the Marxist approach implicitly carries with it the notion of agency and is inescapably entangled in the controversy of "overcoming the tyranny" (Rose, 1998). Associated ideologies see reform as stemming from the re-acquisition of volition by the proletariat. To such a "mind first" revolutionary principle, cultural evolution (Fog, 1997) is anathema.

Gottsch (2001) introduced the concept of *theistic memes* to refer to commandments and dictated behaviours attributed to God. These have used to trace the evolution of Jewish, Christian and Islamic canons originating from the *Epic of Gilgamesh.* Theistic memes have been transmitted (with mutation) over time from generation to generation (vertical transmission) and have been selected and incorporated in to a number of religious texts.

Though Gottsch concurred with Pitt (1997) that some minority is responsible for choosing the content of religious text he suggests criteria of theological consistency and stability rather than as an instrument of dominion of one group over another.

> A process in which those exercising authority in a population select and exclude material in written texts thus developing a non-contradictory religious canon with coherent theistic memes, has occurred since the time of the ancient Babylonians. In general, theistic meme selection is attenuated over time as the text hardens into inviolable canon. Here, religious canon is defined as consisting of theistic memes faithfully transcribed from generation to generation. In the genesis of a canon or orthodox literature, after an initial period of competing theistic memes one group eventually prevails over others. – [Gottsch, 2001]

Gottsch, following Ehrman's (1993) categorisation of ways in which intentional modifications may be made to biblical text, provides an additional and more memetic orientation to scriptural variation.

> However, in some instances the author of the alterations has the sole intention of creating text to render a Canon more orthodox and does this by importing biased memes or by modifying or elimination memes with contrary or completing views. – [Gottsch, 2001]

Although use of the term 'sole intention', given the Darwinian orientation of memetics, is ambiguous, it is clear that canonisation involves the evolutionary processes variation, retention and, according to Piper (1997), reproduction of components to produce a fitter memeplex (Blackmore, 1999).

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i Statistics on NRM adherents http://cti.itc.virginia.edu/~jkh8x/soc257/lectures/whocult.html

ii http://www.christianitymeme.org/essence.html the Christianity meme website

iii http://www.student.nada.kth.se/~nv91-asa/weirdness/meme the holy salvation meme

iv http://www.abarnett.demon.co.uk/atheism/theism_index.htm

[v] http://www.lucifer.com/virus/ Church of Virus website

[vi] Extropian institute http://www.extropy.org/

[vii] http://www.youthspecialties.com/articles/topics/theology/Jesus_meme.php Jesus Meme

[viii] http://www.student.nada.kth.se/~nv91-asa/weirdness/meme

[ix] http://pespmc1.vub.ac.be/Conf/MemeticsAbs.html memetics symposium papers

Appendix M Auxiliary observations

Along with the criteria for validating the hypothesis there are some auxiliary supporting expectations and observations that arise from the study. No methodological claim is made to their truth as they are an aside to the centeral research objective; rather they are included in this appendix as interesting for further investigation.

The criteria (§3.2.1) that lead to the selection of religious bodies (§3.3.1) of which four constituents are observed (§2.2.2) that faith groups (a) exist in a *religious marketplace*[1], (b) exhibit structural, ritual and other ecclesiological traits (c) show a wide *theodiversity* of denominations, sects and cults (d) are selected by their viability in the eyes of adherents[2]. In suggesting the isomorphic proposition, further constituents (§2.3.1) of an abiotic model of religious bodies are anticipated whereby:

(e) *duplication* of religious bodies though
(f) *imitation* of an underlying theological
(g) *business blueprint* whereupon a denomination's traits are the
(h) *actualisation* of that blueprint.
(i) *Variation* upon the blueprint manifest as
(j) *innovation* in a faith group's traits that induce
(k) *splitting* by cladogenesis and result in a
(l) *phylogeny* of faith groups.
(m) *Biological methods* can be applied to the diversity of traits to provide a
(n) *reconstruction* of the phylogeny.

Notably, in presupposing the constituent of *phylogeny* (l) when selecting religious bodies as the test group translation of both direct and indirect *methods* (m) is enabled that provides the independent yet comparable iterations of *reconstruction* (n) necessarily to evaluate the methodological hypothesis.

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[1] A term I overheard in a Christian bookshop.

[2] The viability of a denomination, in the eyes of an adherent, may have little to do with an apparently valid theological route to salvation and selection does not imply "choice". The Spanish inquisition and early converts who "embraced" Islam are just two of the cases in point.

Interestingly, notions of doctrinal catechism, canonisation[3] and heresy have been long known in the Church although their analogues to Darwinian processes upon memes aren't at the forefront of pontifical dogma.

Of the additional expectations, (m) translation of biological methods for the (n) reconstruction of phylogeny of faith groups was evident. The other constituents of an abiotic model of religious bodies require a little more explanation but may be considered briefly as: (e) duplication by congregational formation, (f) imitation by indoctrination, catechism or literally by *imatatio Christi,* (g) having a doctrinal blueprint (e.g. ecclesiology, sacramentology or other aspects of systematic/dogmatic theology), which is (h) actualised through administration. (i) Variation on doctrine, manifest as (j) heresy that often leads to (k) schism and (l) the branching heritage of the church (phylogeny).

Duplication, imitation and doctrine

Even were it in the absence of the hypothesis of descent, duplication and parent-child relationships between religious bodies are immediately visible. On the one hand, faith conversion (stemming from outreach, evangelism and missionary work) leading, given sufficient coverts, to the formation of a new congregation, may be considered as an example of creation of a new species member. Indeed inherent in Catholic theology and causing the Apostolic Succession of the Pope and the sacrament of Holy Orders, is the principle of lineage starting with the Godhead. Denomination, in the etymological sense of group naming, also provides evidence especially where names resemble each other[4]. Indeed, the very term *Reformed* denotes descent with modification. It was the principle of duplication that enabled genealogical methods to be applied to religious bodies.

Although the methodology aims to demonstrate a mechanism of inheritance through congruence between independent reconstructions, direct evidence of inheritance can be seen. Looking at taxa from the genealogical phylogeny and examining their characters, it can be seen that within a lineage relationship, there is a traceable

[3] See Gottsch (2001) and §3.3.3.3 on canonisation as a form of seletion

[4] Seventh day Adventists and Davidian Seventh Day Adventist Association or The church of Jesus Christ of Latter Day Saints and The church of Jesus Christ of Latter Day Saints are prime examples.

commonality of characters. A striking example is within the Adventist grouping whereby all the descendent denominations and sects of the Seventh Day Adventists uphold the Sabbath. The most valid explanation for this is that the Sabbath doctrine (by definition of doctrine) is vertically transmitted (inherited). Again, theological (and sociological) terminology provides explanations for inheritance: such as outreach, proselytising and evangelism (to gather converts), the alpha course, preaching, indoctrination or catechism (consolidation through teaching), or various forms of milieu control such as threats of *defellowshipping* or ostracism of apostates (to retain converts).

Variation and schism

In a similar way that inheritance is directly evident from the data, so too is theological variation. Levels of variation unorthodox, heterodox or heresy represent deviant opinions from the established interpretive norm that can result in schism. One of the most historically significant variations being Luther's proclamation *sola fide* (that salvation is by faith alone independent of works), which was at odds with the Roman Catholic, view on salvation, thereby influencing the reformation (Sproul, 1995). A pattern found from faith groups is that dissenting voices are raised at some governance or theological issue, often over some inconsistency; hypocrisy or scriptural reading that has become institutionalised. A subsequent heated argument develops, usually between a pastor of some congregation and the central religious body that results in the pastor being ousted and taking the congregation with him.

Cladogenesis

Heresies, and other breaches of unity in faith over doctrinal or political issues have indeed occurred. Where these have reached the point of being irreconcilable, then schism has resulted in the emergence of new denominational forms. In most instances a faith group is divided over some point, and forms a breakaway group – thereby splitting the main branch into two (i.e. bifurcation). In some cases, initial branching seems to provide impetus for further branching over other issues thereby leading to evolutionary bloom. This is evident in the reformation (as well as other periods). It is acknowledged that the *cladistic* splitting is not the only pattern of denominational change. Another pattern is also evident in the way that certain liberal denominations, such as the Church of England, attempt to reinvent themselves to fit in with prevailing

socio-environmental factors without causing too much internal upset. Fundamentalist or Conservative denominations, on the other hand are less tolerant to change. At this time it is uncertain whether this pattern is more akin to organisational *anagenesis* (speciation without splitting) or intra-specific variation enabled by a "liberal" meme, but within boundaries, or something else. The pattern of descent, does however, seem to confirm that cladogenesis is a dominant way in which new organisations emerge (see Figure 4-1 in §4.2.4).

Iterated cladistic splits predict an increase in the number of denominations and not just of congregations or adherents. Even though the scope of the study was strictly limited to a small subset of western Christian faith, it is apparent that since the pre-16th century dominion by Roman Catholicism, the diversity of western Christian faith has expanded vastly. Of particular importance is the colonisation of the North American continent as this has given rise to immense theodiversity.

Patterns of phylogeny

There were two patterns evident in the genealogies. The first was *diversification* whereby, for whatever reason, a lineage bifurcated. The second was *integration*, which involved the merger of two or more lineages and was particularly evident in the Methodist and Pentecostal lines. In both cases there was a split and then a merger between two (or more) parties that had split. The merging parties were closely related while nowhere was it found that distantly related parties merged. It may be concluded then that whatever caused the split was a minor difference and insufficient to maintain a permanent schism and that communion was more important that the point of issue thereby allowing the argument to be resolved. During the first half of the twentieth century, the Pentecostal Assemblies of the World (PAW), for example saw much splitting and re-merger owing to racial tensions (Beisner, 1998). Analogy may lie with intra-specific variety whereby there is insufficient variation to cause speciation. It is interesting, historically, that despite Wesley's proclamation that he lived and died a member of the Church of England, Methodism arose from a split (originating from Wesley's ordination or Thomas Coke in 1784) that has resisted all subsequent attempts at reconciliation (Bates, 1977).

Another recurring pattern was an intermediate split occurring between a split and re-merger (Fig. 3-12) as exemplified by the Salvation Army (§3.4.3.2.4) that split from the MNC in 1861 and gaining permanent independence in spite of Methodist reunification in 1932. In such case it would appear as though the original split results in two denominations that are "one step" away from each other and are close enough to merge. The intermediate schism however has created a denomination that is yet a step further removed and beyond re-integration.

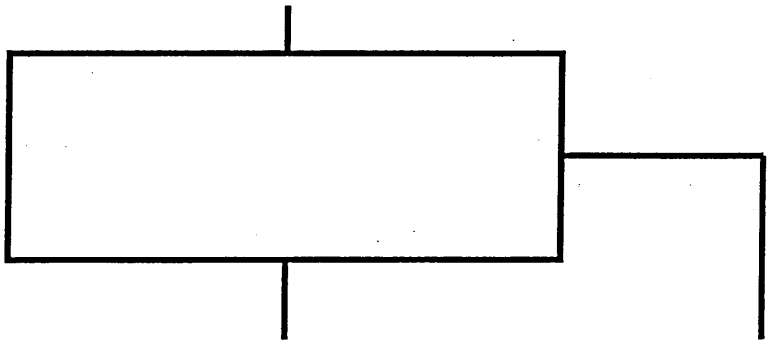

Figure 3-12: pattern of intermediate split

The general pattern however is continuous move towards ever-greater diversity over time, which is consistent with the expectation that there would be a fan out pattern in the phylogeny.

Blooms and extinctions

By analogy to biological population dynamics, it is expected that various religious forms will experience times of rapid diversification while at other times see many forms meet their demise. It may be possible to evaluate strategic theology (Coleman, 1982) from a cultural r/K perspective (Fog, 1997), similar to science (Hull, 1988) Environmental factors influential to this will include political, technological, scientific, geographical, economic as well as the influences of other religions (such as conversions between them). Blooms were evident at several occasions.

- Luther's posing in 1517 of the ninety-five theses and the significant events that followed over the next 20 years. In 1520 Luther came out of hiding and began to re-establish order. In 1534 Henry VIII breaks England away from the Catholic Church, thus beginning the Episcopal Church. John Calvin publishes

Institutes of the Christian Religion, in 1536 as one of the most influential works of Protestantism (Sproul, 1995).

- Methodism was an offshoot of the Church of England. After Wesley's death it became another example of a bloom whereby a number of offshoots emerged (circa 1800). Many of these later reunified and although the split between C of E and Methodism has never successfully been repaired (Bates, 1977; Davies, 1976; Fairbank, 1983).
- The Millerite movement's *Great Disappointment* of 1844, which anticipated the specific day of the return of Christ to be October 22nd. When this prophesy failed to happen, the movement disbanded. Some, however reinterpreted the prophecy and began to form new groups of Adventists. (Linden, 1978; Tucker, 1989; Berry, 1987; Mather & Nichols, 1993).
- The Pentecostal bloom, emerging from Dowie's City of Zion and Azusa Street occurred at the turn of the 20th century. (Beisner, 1998; Burgess & McGee, 1988; Mather & Nichols, 1993)

Other, more recent events include Brownsville, Calvery Chapel and the Toronto Blessing.

Extinctions, on the other hand, were not as overt. With perhaps the exception of Failed Millerite prophesy or David Koresh's prophetic self-fulfilment and the demise of the Branch Davidians on April 19th 1993, most groups no longer in existence tend either to fizzle out or become assimilated into some other closely related group.

Additional observations

Although the research was aimed as demonstrating the hypothesis with supporting observations, there were certain surprising anomalies that came to light during the programme's course, which later proved concurrent with a memetic explanation. The first concerned confusion over Baptist doctrine while the second stemmed from a proposed explanation for error in phenetic reconstruction.

Particular Baptists

The problem of homonymy and synonymy has been highlighted (part 2) as causing problems with identification of a particular organisation. The problem became apparent during research with respect to a confusion surrounding Baptist's. The way that the problem was resolved inspired confidence in the method's validity.

Initially, there was no distinction drawn within the concept of Baptism. It was initially assumed that Baptism was a denomination in much the same sense as Methodism and that the name simply reflected an emphasis on the sacrament of baptism through re-baptism as an adult. Historical information had suggested that the Baptists originated in England around 1608 as a separatist's movement from the Church of England.

During the course of characterisation, the researcher was experiencing difficulties determining certain states and so, although not a stated part of the methodology, a complementary approach to data gathering and lead generation was adopted. This involved utilisation of Internet chat rooms with a Christian feel. A loose "cyber-ethnomethodology" involved the researcher posing as a naive visitor out to find new Christian friends. Invariably, the small talk would involve people asking "A/S/L"[5] at which point it became pertinent to inquire as to the denominational affiliations of others. This paved the way to inquiry as to the states of peoples belief systems.

Unfortunately, the *signal to noise ratio* in many of these chats was poor and the amount of directly useful information gleamed was disproportionate to the time and call charges involved. Most of the activity seemed to involve "chirping" (mindless chat), various praises to Jesus, proclamations of faith, cheesy slogans, ASCII angels,

[5] Short for "Age, Sex, Location?"

or biblical quotations[6]. One chat that did reveal quality information was a discussion with a Calvinist about the meaning of TULIP[7]. Upon inquiry as to the denomination of that person, they stated that they were a member of the Southern Baptist Convention.

Upon consideration, it would appear (under the assumptions) that Calvinism would contradict Southern Baptism. If Southern Baptist's, being Baptist as the name suggests, were more related to Anglicanism and, if Anglicanism and Calvinism were entirely different lineages, then the theory would suggest that Southern Baptism would not resemble Calvinist theology[8]. Hence an alternative explanation for the statement was needed.

- The person I was chatting to was confused as to either the meaning of Southern Baptism or Calvinism. This seemed unlikely based on the quality of the other information and links the person was supplying.
- Southern Baptists are not Calvinist except the person I was chatting to who made this theological decision independently. This was refuted by the Southern Baptist Convention's home page that upheld Calvinism in no uncertain terms.
- The original formation of Baptism was around views that were later to be recognised as Calvinist
- Formation of Southern Baptism stemmed from Baptism but a new organisational hybrid was formed by the adoption of Calvinist views. Horizontal transmission of memes (inter-organisational) would create methodological difficulties.
- Southern Baptists are a different denominational form and have a lineage that is unrelated or distantly related to those Baptists identified save in their emphasis on baptism (hence the commonality of name).
- Some other "leap of faith" occurred

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[6] One annoying feature of some rooms was a "biblical bot", an automated program that served biblical tracts. One particular character was behaving as such a bot and the researcher inquired as to such. It turned out that that character was not a bot but actually human. Memetic jargon would term this kind of person as a *memebot* or human who would fail the Turing test.

[7] See section on Calvinism (§3.4.3.2.3)

[8] This would be like saying you inherited your eye colour from your uncle.

Subsequent research, then, involved reconsidering the history and origin of Baptism and its ancestry. It transpired that Baptist clade was essentially split into two camps. On the one hand were the General Baptists who upheld beliefs in the Armenian view of *general atonement* that Christ died for all, but that his death would only benefit those who would choose him. Particular Baptists, on the other hand, believed in *particular* or *limited atonement* whereby salvation was limited to the elect. Limited atonement is the third of the 5 points of Calvinism ("TULIP"). Another important fact that reviewing history revealed was that Particular and General Baptists did indeed have different origins and that the General Baptists did indeed originate in England. Southern Baptism then had its roots in Particular rather than General Baptism.

This distinction allowed for the replacement of Baptist as an OTU with its components of Particular Baptist, General Baptist and Southern Baptist Convention (PB, GB and SBC respectively). There were other candidates such as the Northern Baptists, Primitive Baptists (and so on) but these would provide proportionally less value to the study and so were left out pending future research. Refining OTUs also revealed the character distinctions in soteriology of general and particular atonement. Again, these revealed yet greater metaphysical distinctions that had little value and so were omitted.

Papal power and the might of Rome

The second surprise stemmed from an attempt at explaining the imprecise congruence between dendrograms. The initial results were taken across all characters and weighted them as equal accordingly with the UPGMA strategy. It was found that at the micro level, the correspondence was strong; where two OTUs where closely related by descent then they were also closely related on the phenogram (Appendix G). This was reliable for four phenons groupings that may be called Episcopal, Reformed, Pentecostal and Adventist[9]. Within these four phenons, the micro level relationship between the OTUs reflected the known pattern of descent. On the macro level the phenogram abstract (figure 3-13) showed a *cascade* pattern such that in descending order of resemblance (top to bottom) were the Episcopalian and Reformed, Pentecostal, Roman Catholic and then Adventist groupings.

[9] Roman Catholic and Quaker were anomalous as they were not encapsulated within denominational families.

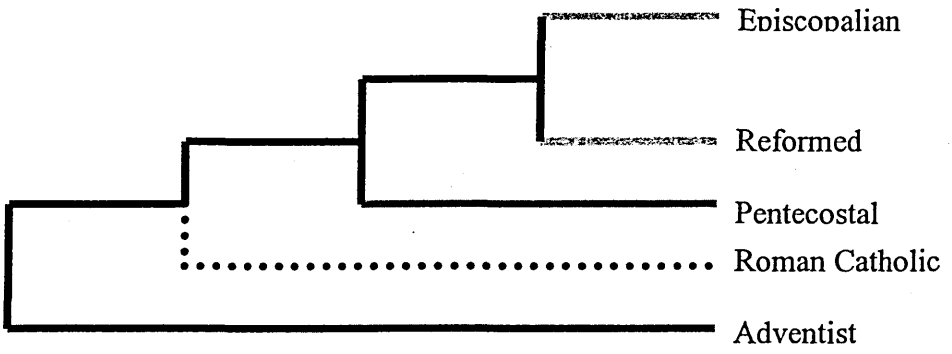

Figure 3-13. Un-weighted test

One interpretation of the genealogical phylogeny (fig. 3-10) would suggest that the Episcopalian (including Roman Catholicism) would constitute a phenon separate from Reformed, Pentecostal and Adventist one however this pattern was not reflected in the *un-weighted* phylogeny (fig. 3-13) and it was initially suspected that mismatching was due to the phenetic strategies chosen.

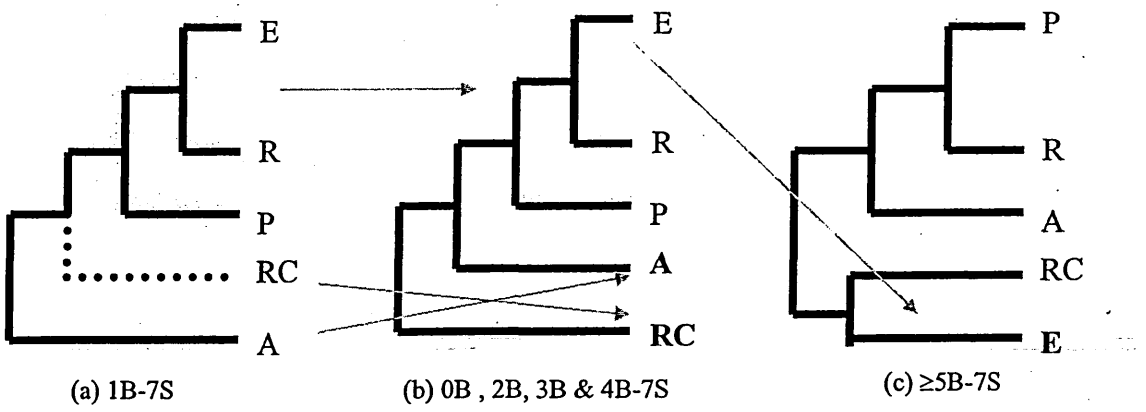

Figure 3-14. Bishop weightings (7 sacraments):

Simulation of weighting: 5 bishops

It was observed that greater diversity accompanied the absence of Episcopal polity, raising the hypothesis that stability of other characters (lock in) was influenced by the power of the Episcopate. Simulating other bishop weightings would enable testing to assess the impact on the phonogram's structure. An experiment was suggested[10]: new "bishops" were to be added one by one (by copying and pasting a column) iteratively, printed-out and abstracted (using highlighter pens) and compared. From the un-

[10] By Price (private communication)

weighted case[11] (fig. 3-14a), the addition of a second "bishop" saw a switch between Adventism and Roman Catholicism; a third and fourth "bishop" made no further structural switches (fig. 3-14b); the addition of the fifth switched the Episcopalian phenon rendering the structure to that which was anticipated from the genealogical phylogeny (fig. 3-14c). To see if any further changes would be made, 9 and 17 Bishops were also tested but these turned out to be identical to "5B-7S" case and so it was assumed that stability was achieved after 5 "bishops" (Fig. 3-14c). Out of curiosity the zero bishops case was also tested, interestingly this turned out to be structurally the same as the 2 to 4 bishop tests (Fig. 3-14b). During these re-weighting experiments, the "micro" level remained consistent.

While some denominations exhibited no sacraments, most exhibited two (Baptism and Eucharist[12]) Roman Catholicism uniquely maintained all seven. Trials were conducted on "1B-3S" and "5B-3S" cases however, the results were uninformative; no other weightings were tested.

It was not anticipated, but nevertheless important that above 5 bishops, congruence was achieved at both macro and micro level (see figure 3-11). The significance being that methodological refinements are suggested: although the UPGMA assumption was, WPGMA[13] would have given superior results. MENDEL was specifically designed to incorporate other options but unfortunately limited time and resources prohibited experimental sophistication (§4.2.1). An account for Episcopal power will be attempted in the analysis (§3.4.8.6).

Analysis

The specific results of the test of the method upon faith groups will be analysed in this section. These are examined in terms of their orthodox rational along with likely memetic explanations. The validity of the test group, methodology and hypothesis will be analysed in Part 4.

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[11] The nomenclature used depicts the weighting of bishops B and sacraments S. the equivalent weight of the "un-weighted" case is "1B-7S" denoting that each trait is given a singular weight.

[12] The dominical sacraments (their institution by Christ himself) are evidenced in the NT and are considered by the main protestant confessions to be the only sacraments necessary for salvation. (Richardson: A Dictionary of Christian Theology)

[13] Weighted version of UPGMA

Analysis of anomalies

It was anticipated that for each denomination there would be a single parent, however this did not turn out to be the case as it was evident that mergers of faith could occur. This would have presented methodological difficulties if the mergers hadn't been between variations that were closely related. Fortunately this was analogous to intra-specific variation whereby interbreeding could still occur. It was taken then, that mergers were not between different "species" of faith and therefore the split that produced the merging varieties was not a cladogenetic emergence of some new specie. Hence, the subsequent merger of a split meant that the split would be rejected as being a phylogenetic event. This meant that the single parent observation was preserved.

Analysis of corresponding observations

The patterns encountered between relationships of faiths were that parent-child relationships enabled the direct tracing of lineages and the construction of a "family tree" of faith. This is validated, as there is sufficient historical evidence to suggest that parent-child relationships do exist even though there were difficulties in establishing certain specific ones owing to confusions and contradictions in the literature. It was also validated that this isn't a single layer parent-child relationship, but rather a recursive pattern of lineage. Furthermore, and as anticipated, there was a diverging pattern as opposed to a single (or parallel) lineage.

Divergent lineage is indicative of a pattern of descent and therefore replication with variation. As the genealogical phylogeny corresponded to this general fan out pattern, then this was an initial indicator that some mechanism of replication with variation was occurring. In other words, there may be a memetic replicator present in patterns of the spread of faith as hypothesised.

Correspondingly, the presence of a replicator would entail character inheritance with variation leading to increasing diversity, which is a characteristic pattern of cladogenesis. The dendrogram comparison was used to qualify the pattern and was directly supported by historical narrative. In many cases it was possible to identify the "issue" that caused disagreements and eventually a splitting: theological, moral,

political or otherwise. Factions were divided predominantly over this issue, but otherwise concurred. Acceptance of a doctrine (literally teachings) corresponds to inheritance. Where an argument breaks out over some doctrinal issue then an incompatible variation has been introduced which may bring about schism; the memetic stance may concluded that variation in the faith replicator has occurred at some memetic locus resulting in denominational cladogenesis. Further, the anticipated increase in theological diversity was evident suggesting that that other combinations in meme space were being explored.

Problem of homonymy

It was seen that the problems of vernacular naming was present in faith groups whereby a critical distinction between particular and general Baptists was overlooked. Presumably the reason for this blurring arose from denominational naming on the bases of their single prominent character of re-baptism and the lesser distinction (particular or general) is based on the essential difference in views of atonement. This naming and monothetic classification by the prominent character therefore has lead to homonymy whereby two separate groups have been daubed with the same label. The classification however does not reflect the descent as it was discerned that particular and general Baptists were from different historical backgrounds.

As to how two denominations from separate lineages came to exhibit the common prominent characteristic of re-baptism, the one likely phylogenic scenario may be analogous to convergent evolution. This is where two unrelated species, faced with similar environmental challenges, evolve similar anatomical solutions. In the context of *solifidianism* inherent in Protestantism, the bible (*sola scriptura*) is accepted as the single formal cause of justification (Sproul, 1995). There is a drive to go against anything that is "non-scriptural" and to return to biblical authority. The theological augments are involved but a common conclusion is the necessity for *Anabaptism* (re-baptism with the confession of faith as an adult). In the prevailing climate of dissent and Protestantism, there is a probability that a faith group would reach the conclusion of the necessity of Anabaptism, which would be a distinct enough character to be labelled as Baptist. Another such group were the Swiss Anabaptists that predated both general and particular Baptists and it its possible that the Swiss group were ancestral.

From a memetic perspective, however such theological conversion may be explained as the reactivation of a dormant meme. By the introduction of the minimalist *sola fide* meme (and its implication of *sola scriptura*) then the biblical memeplex is re-invoked in its entirety, which debases competing memeplexes such as those preserved by the papal authority meme. The argument then becomes over what is scriptural and what is not. By this reasoning, it would appear that Anabaptism meme (e.g. John 1:33) was dormant in the biblical memeplex until re-invoked by the *sola fide* meme.

This was a poignant example of the problems and possible reasons for of homonymy and synonymy. The full extent of the problem however is not known.

Predictive power of theory on religions

The distinction between particular and general Baptists had been masked by homonymy and becoming aware that there was a distinction was an entirely unexpected side effect of the research process.

It would appear however that historical events could be mapped reliably onto a snapshot of the current state. Characters of extent denominations are related by descent. Where there is a discrepancy then either the characterisation or historical accuracy may be challenged. In terms of Calvinism and Baptism a "historical prediction" could be made which suggested the presence of some hitherto undiscovered faith group. Subsequent search verified this prediction. It is unlikely that the distinction would have otherwise been made.

Power of bishops and sacraments

The curious effect of simulating re-weighting of the Episcopalian character upon the structure of the phenogram alludes to the role of the episcopate in church order. The hypothesis here is that the presence of a bishopric confers stability to the memeplex as a whole and their power and authority inhibits mutation.

The history of the Episcopalian character and associated characters (particularly evident in Roman Catholicism) reveals how this may be. The term Holy Orders is applied to several offices within the ministry of the church Roman Catholicism, since innocent III in 1207, recognises three major orders (bishop, priest, deacon and sub-

deacon) and three minor orders (porters, exorcists and acolytes). Anglicanism and Eastern Orthodox recognise only the first 3 major orders. In all cases a bishop is the most important and only a Bishop can validly ordain. It is by these orders that the sacraments are validly administered[14] (Richardson, 1969).

According to the Roman Church, Orders

> ... is a true sacrament instituted by Christ who ordained the Apostles at the Last Supper. It is administered by the laying on of hands and the key phrases of the ordination preface. [http://www.catholic.org/prayer/orders.html].

Orders then enable the continuation of Christ's ministry on earth through man and the apostolic succession relates to the view that episcopacy is derived from the apostles by continuous succession.

More specifically for Roman Catholics, the office of bishop of Rome maintains its claim to universal spiritual authority and jurisdiction; the heights of papal power being with Innocent III (John, 1964; Cunningham, 1983; Ullmann, 1972). Papal infallibility (defined by the Vatican in 1870) means that a doctrine stated by the pope is endowed with infallibility and is irreformable. Challenges to the order have historically produced splits: Martin Luther's protest at the sale of indulgencies lead to the reformation; Henry Tudor's personal matrimonial agenda and the formation of Anglicanism; and the "illegal" ordination by a non-bishop within Methodism.

The trait of *solafidianism* can be seen as incompatible with holy orders. *Sola fide* implies a direct connection with god and route to salvation without need for sacramental administration by an ordained minister. Though reduction of the importance of the other sacraments greater emphasis is placed on the role of baptism as first grace. Justification by faith alone relinquishes the reliance on Vatican moral authority, as according to Luther, all doctrinal matters are confirmed *sola scriptura* (Sproul, 1995). Taking the bible as the sole measure of authority not only broke orthodox monopoly on scriptural dogma but also the umbilical chord with the Vatican enabling independent governance and Presbyterian and congregational polity to emerge. These factors (among others) lead to the reformation and the fissiparous

[14] With the exception of baptism, which may be administered by anybody, even a heretic.

nature of Protestantism. A similar threat to Vatican power was the English translation of the Latin vulgate by Wycliffe in 1382 who was condemned pope Gregory XI.

Meme theory might make suggestions: Holy Orders and the episcopate (particularly the bishop of Rome) are memes that lock-in the state of other memes and do indeed defend orthodox faith against heresy. When these *horseshoe nails*[15] are removed then the Christian memeplex becomes destabilised and begins to explore faith-space. Luther's action punctuated the Roman Catholic equilibrium and invoked a bloom in religious form. Similar arguments could be posited for the formation other denominational families.

Concept of canonical memes

While rejecting papal infallibility, Protestants assert biblical inerrancy (Sproul, 1995) necessary for *sola scriptura* guidance. Gottsch (2001) notes how theistic memes cement into inviolable canons while Piper (1997) argues that biblical text represents a replicating memeplex. In spite of fundamentalist declarations of biblical inerrancy, the testaments contain many contradictions, omissions, ambiguities, allegories and confusions, which are the subject of interpretation. As previously conjectured, the hermeneutic context, which provides an interpretive framework for scripture, also constitutes a memeplex that replicates between adherents. While the text itself may be *bradytelic,* providing the appearance of immutability, its hermeneutic context is *tachytelic,* giving rise to the evolution of Christian denominations. Memes such as episcopacy are suggested to be traits of the hermeneutic context that preserve (lock-in) orthodox interpretation and administration of *the Word.*

It would appear that in a memeplex, memes have varying degrees of stability, importance and influence upon each other. From the study there seems to be three levels:

1. *Trivial* Differences in certain issues within a faith group do not seem to upset the structure of the group. These range from idiosyncratic viewpoints to the unorthodox. While they may cause in-group amusement or heated debate, they do not carry sufficient weight to threaten schism.

[15] A small action with a disproportionately large consequence (Flynn, 1990).

2. *Critical* Where an issue becomes heavier it may become critical to the structure of the group. Disagreements at this level are generally accompanied by a breach in unity. The typical pattern followed was a pastor of a congregation would make an alternative interpretation, which would be unacceptable to the denomination. Often, the pastor's actions would result in his excommunication (or retirement) and the formation of a new congregation, which may in turn develop into a new denomination. An example was the heretical teaching of Victor Houteff resulting in his expulsion from the Seventh Day Adventists Church and the formation of the Davidian Seventh Day Adventist Association (Linden, 1978).
3. *Canonical* Some beliefs systems are fundamental and common to all denominations of Christianity. A challenge to them would constitute such a severe shift that the schism would not considered to be of the same religion. An example of such a meme would be the denial of Christ. These may be called "Canonical memes", carry the most weight and are the most stable.

The boundaries between what constitutes trivial, critical and canonical seems to depend upon whether the denominational family has a more liberal or conservative orientation. A conservative faith group tends to be less tolerant of alternative opinions and is likely to de-fellowship those who do not adopt their ideologies. The post-modern nine o'clock service, on the other hand almost took on a cultish accent before the Church of England excommunicated its leader.

Appendix N

Squaring off about Darwin: Runciman vs Giddens

There is a contemporary resurgence of interest in social evolutionary theory as exemplified by a recent debate between Runciman and Giddens[1].

Social Darwinism suffered as being both a poor science and at the hands of racist agendas.

> Some sociologists' resistance is probably a legacy of social Darwinism, with its exaggerated stress on individual competition and overtones of racism. But the point about social Darwinism is not that its ideological presuppositions have been discredited; rather, that it was bad science. Had the social Darwinists known what neo-Darwinians now know about evolution, they would not have reached the mistaken conclusions they did. – [Runciman, 1998]

Sociobiology's failing was that it projected gene-centred theories into domains that they did not belong. Evolutionary psychology has been cautious not to repeat these mistakes and has adhered to its core emphasis on the origins of the human brain and mind.

> Evolutionary psychology tries to identify the universal functional designs inherent in our brains at all levels (in other words the genetic commonality and not difference). – [Lucas, 2000]

The scientific study of culture and society has been stuck in the doldrums. Complexity theory, neo-Darwinism and Universal Selection Theory (Cziko, 1995) are, however, allowing for the reformulation of a neo-positivist[2] sociological meta-narrative based on evolutionary theory. Runciman (1998) had noted social commonalities to biological systems[i]

> The information contained in the rules of the institutions to which we belong as organisms with minds interacting with one another in our various roles, guides our social behaviour - as wage earners, churchgoers, voters or footballers. This open-ended handing-on of novel instructions to successive carriers of the units of selection gives the neo-Darwinian approach its purchase at all three levels. No doubt there are many disanalogies between biological, cultural and social evolution, but the three exist on a continuum. It therefore makes sense to apply the concepts of variation, replication and selection at all three levels. – [Runciman, 1998]

And Lucas, by using "predisposition" to accommodate for exogenous factors, extrapolates evolutionary psychology to social realms

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[1] Held at the London School of Economics on the 20th of June 2001between Anthony Giddens director of the LSE and Gary Runciman, Senior Research Fellow in Sociology at Trinity College, Cambridge. I attended and initially wrote this section with the intention of separate journal publication. It is presented here without stylistic modification.

[2] Explored further in §2.2.1.1

> We can say therefore that as the cell evolves in order to adapt to and control its world (evolutionary biology), and the mind does the same at a higher level (evolutionary psychology), so we can assume that society does so too (evolutionary sociology). This latter field seems quite new, but relates to the influence of our psychological predispositions on the structure and processes of our society. It remains to be seen what will come of it. – [Lucas, 2000]

The claim then that all the social sciences should adopt an evolutionary perspective[ii] may seem a little strong and was taken up in a debate billed as:

> Two of the world's leading sociologists square off about Darwin: Runciman arguing that to ignore evolutionary ideas is to relegate sociology to a scientific backwater, Giddens that these ideas are and will remain irrelevant to sociology's true concerns.

Both tiers of the lecture theatre were filled. The upper deck was occupied mainly by students, while the intellectual "heavyweights" including as Daniel Dennett sat below. Richard Dawkins, however, was conspicuously absent. After introducing, with the aid of a slide show, the principle's origins in Campbell's evolutionary psychology, Runciman pre-empted Giddens' potential objections by answering ten arguments commonly levied against his proposition.

1. His position was not the sociobiology of Wilson (1975). Sociobiology suffers from what Dennett (1995) terms "greedy" reductionism in its controversial attempt to reduce human social phenomena, like those of other social species, to their biological functional origins. The revised view rather, considered social phenomena in themselves from a Darwinian perspective. Though core theories may be similar, as Dusek (*s.d.*)[iii] states there is a *'lessening of totally off-the-wall speculation, far fetched animal analogies to very distantly related species'*.
2. Nor was his position the social-Darwinism of Spencer. Rather, the new view is based upon ideologically independent neo-Darwinian understandings. As Runciman had previously stated the real problem with social-Darwinism was that it was 'bad science'.
3. Genetic determinism was also ruled out. Social structure is not encoded in the genotype. Such a notion would be as preposterous as identifying the gene for television watching (Dusek, *ibid*). However, physical traits that enable humans to form social structures (opposable thumbs, upright posture, large brain size, the ability to talk and so on) are expressions of the genes.
4. Runciman also denied that he held the pan-selectionist (Dusek, *ibid*) view of ubiquitous selection. In this view, and in the words of Darwin himself (1859) "natural selection is daily and hourly scrutinizing throughout the world, every

variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good". This is a view which Gould (1997)[iv] has daubed "Darwinian fundamentalism".

5. Further, the processes of social evolution did not proceed in a simple unilinear sequence of stages but were considerably more interweaved and complex.
6. Nor was the view a metaphor for a process of information transmission that used the language of biology. Rather, it was seen that society was an extension of and followed along actual similar evolutionary lines to that of biology.
7. As to the challenge that the assumptions were untested, it was argued that they were as certain as those of evolutionary biology.
8. A similar challenge was that science should make predictions yet evolutionary psychology shies away from doing so. Runciman argued that the theory of natural selection doesn't make progressivist predictions about the direction of *evolutions arrow* (Stewart, 2000). It is as futile to anticipate the character of future societies, as it is to guess what kind of creature humans will evolve into.
9. The theory was explicitly dysteleological in that it viewed evolving societies as not being directed towards any purpose or deliberate intention but rather are shaped by natural social forces.
10. The last point Runciman raised was that evolution was not a loose metaphor or "just so" story to explain for occurrences of sociological phenomena but rather, an actual account of the process of social development.

Giddens responded without standing from his chair and remained calm, diplomatic, supportive yet sceptical about his opponent's propositions. He stated that he supported a collaborative program of social research with the natural sciences and considered that contributions to understanding could be achieved. However, he didn't think that the terminology translated and that biological evolution provided no more than a loose metaphor that, if taken too literally or too far, would be in danger of clouding social understanding. Social systems, he claimed, depended on different dynamics. Giddens neither disputed the influence of evolution on human nature nor the importance of Runciman's research programme. His main concern was as to what difference embracing evolutionary theory made to the current state of social research and to himself as a practicing social scientist.

Giddens admitted that he only had passing familiarity with subject of evolutionary biology and had only recently read Dawkins, Dennett and others for the purposes of the debate. Even from this skimming, he said, it was apparent that there were glaring problems in the theory and went on to list seven objections.

1. It seemed as though it were the "blind leading the blind". Giddens claimed that biologists did not know the social sciences and so.making direct inferences about society solely from biological knowledge was misguided.
2. Another problem with the field, and one which Dawkins, in the foreword to Blackmore's *The Meme Machine* (1999), also points out, is that the attraction of evolutionary theory towards the "wild fringe" degenerates it into a "non-science" thereby reducing scientific credibility and giving it a bad name.
3. From his admittedly limited survey Giddens classed that evolutionary explanations for social phenomena provided merely "plausible stories" as opposed to confirmed answers. These he could not accept on their appeal alone.
4. Giddens also criticised the circularity of explanations he had encountered and particularly in the way that a loose analogy was being employed to draw plausible, yet unconfirmed inferences about social phenomena.
5. Humans are epigenetic agents[v] meaning that it is not only the genome but also the environment that influences the development of the individual. He illustrated this using a metaphor whereby bookings may be pre-arranged by the travel agent (the genes) yet the customer (the sentient individual) undertakes the actual holiday.
6. The point that humans are concept-bearing agents capable of autonomous creativity builds upon the point that we are not products purely of our genes alone but are capable of generating behaviours that are not genetically pre-encoded. Giddens explained that a person couldn't commit suicide without knowing the concept.
7. Giddens concluded by saying that in the current state of the proposed theory there was not much that would change his view as practising social scientist.

Though unconvinced, Giddens explained that he was not trying to trivialise the research agenda and pleaded for a continuing dialogue but he added exogenous factors must be taken into consideration.

Runciman replied by saying that Giddens *'kept on about equating evolutionary biology to social science'*. Runciman explained that he was not defending sociological reductionism. The theory was not about evolutionary biology, there were far too many disanalogies, but rather about viewing genetic, cultural and sociological factors from a Darwinian perspective.

'Current state of knowledge didn't show me much, that's all I want to say' commented Giddens.

Questions and comments from the floor saw examples of evolutionary inferences on social development. Daniel Dennett pointed out that there seemed to be excellent social "design" that are actually designed by no one. We make up some story to account for their occurrence. One of these is to see things as "obviously designed" by a rational intentional intelligence (in the same way that religion does). Another way is to consider evolution and emergent self-organisation. Social "designs" were not themselves genetic but interacted with genetics. Giddens didn't see a directly analogous mechanism and so put such inferences into his plausible story category. Runciman had the final word by proclaiming that Darwinism provided a deep and powerful theory for understanding socio-cultural entities.

Interestingly, although *The Selfish Gene* (Dawkins, 1976) was directly cited, the "M word" was never uttered by any of those on the platform. The concept of the meme was curiously downplayed by both Runciman and Dennett, both of whom have employed it in their written work. The term was only explicitly used when Paul Marsden's (inevitable) reply to Gidden's view of suicide, drew attention to the influence of autonomous replicators as a candidate mechanism. As Blackmoor, (1999 p8) notes in *The Meme Machine.*

> the word 'meme' is so often written with inverted commas around it, as though to apologise for using it. I have even seen eminent lecturers raise both hands and tweak them above their ears when forced to say 'meme' out loud. – [Blackmoor, 1999 p8]

The reason for this, she suggests is that the implications, of memes, on what it means to be human are scary. The reluctance to use the term 'memes' in the context of the debate however seemed more reminiscent of the Emperor's New Clothes. The scary

part would appear to be more about the implications for academic reputations than of human nature. Is it that the word 'meme' is altogether too abrupt, too novel or used too frequently in science fiction and cyber-culture to be mentioned in polite scholarly conversation? For whatever reason, it would appear that mainstream academia is not yet ready to forgive Dawkins', even if his classicist friends are prepared to do so.

Giddens, it would seem, had misinterpreted Runciman's point as an attempt to reanimate sociobiology. Runciman conversely, was trying to say that Darwinian processes also shaped non-genetic socio-cultural parameters. However, by suggesting an evolutionary account of society without a non-genetic mechanism then there becomes a gene-centric propensity. Granted, it is possible to consider social evolution without recourse to a second replicator but the simple concept of a genetic analogue resolves many archaic preconceptions and to some extent bridges the chasm between biology and sociology. Prohibition of the word 'meme' inhibits dialogue and does nothing to assist mutual understanding.

Perhaps we would be wise to reconsider using the word '*mimeme*' after all (Dawkins, 1976) so as not to run up academia's immune system. Alternatively we could take Giddens' objections on board and do as David Hull, at the 1999 Cambridge conference, urged us to do. *Stop talking about it and start doing research.* Hull's advice may alter the perception that memetics is as the "wild fringe" of "plausible stories" and may provide something that practicing social scientists would be willing to use. Making memetics and the word 'meme' respectable, through solid collaborative research, can be seen as a major step in the direction of unifying the social and natural sciences. Memetics offers a common language by which biologist and sociologists may talk if they were to accept it.

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i http://www.prospect-magazine.co.uk/highlights/socialising_darwin/ (404)

ii http://www.findarticles.com/m1373/n8_v48/21031902/p1/article.jhtml Jones (1998) http://www.socresonline.org.uk/3/4/6.html Marsden (1998c)

iii http://human-nature.com/science-as-culture/dusek.html Dusek (*s.d.*)

iv http://www.nybooks.com/articles/1151 Gould (1997) Darwinian Fundamentalism

v http://pespmc1.vub.ac.be/ASC/EPIGENETIC.html Principia Cybernetica: epigenetic (def.)